VOL. XXII. Nº 10

OCTOBER 1937

MECCANO MAGAZINE

THE CLIMBER

6D

DRIVER CLARKE SAYS "IT'S FINE!"

The new HORNBY SCALE MODEL OF L·M·S RECORD-BREAKER "Princess Elizabeth"



Four hundred miles non-stop at an average of 70 m.p.h.; maximum speeds of 95 m.p.h.; Beattock bank and Shap incline surmounted at 66 m.p.h. with a 260-ton load! These remarkable feats were performed by L.M.S. 4-6-2 *"Princess Elizabeth,"* in charge of Driver T. J. Clarke, on a special run in November 1936.

Think of the thrill of owning a model of such an engine; not merely a perfect reproduction in miniature, but one having the same qualities of power, speed and efficiency! This is now made possible by the latest product of Meccano Ltd.—the magnificent Hornby scale model locomotive *"Princess Elizabeth."* Look at the photograph above! What a splendid appearance the model has with its massive six-coupled driving wheels, fascinating valve gear, and Royal nameplate! It is driven by a 20-volt electric motor, fitted with the world-famous Hornby Remote Control.

Price, complete with tender, in special presentation box, £5 5s 0d.

The model may be purchased also through the new Hornby Deferred Payments Scheme. Ask your dealer for details (Not available outside Great Britain and Northern Ireland.)

HORNBY TRAINS

MECCANO LIMITED, BINNS ROAD, LIVERPOOL 13

SPECIAL BICYCLE EDITION

SAFETY FIRST CAMPAIGN

Hamley's News

HAMLEY · BROTHERS · LTD · ESTABLISHED · 1760 ·

200-202, REGENT ST., LONDON, W.I. OUR ONLY ADDRESS

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No. 25 October, 1937

AMAZING NEW GADGETS

LET "SAFETY FIRST" BE YOUR MOTTO

SPECIAL DEVICES FOR YOUR BICYCLE

PRICE **6′4½** Post 4d.



TAKE THE RIGHT TURNING

Here is a grand automatic signal, similar to those used on cars. It eliminates the necessity of taking your hand off the handlebars to make signals. Just press a switch on the handlebars and the arrows light up, showing which way you are going. Invaluable in traffic, Easy to fit.

A Flying Mascot



PRICE **1′3** Post 3d.

Your friends will all be envious when they see your fine life-like Blue Tit mascot. Fixed to the handlebars, its wings and tail move in a realistic way.

Late for school again!



PRICE **12′6** Post 4d.

But you can be on time for anything if you fit this fine Bentima clock to your handlebars. Beautifully finished, strong spring, built to last. Luminous dial for night riding.

Light your way to safety!

Here is a front lamp which is indispensable to every cyclist. It throws a clear, bright beam which makes cycling at night a pleasure rather than a strain. Fitted with special dimmer and strong, long-life battery. Strongly built.



PRICE only **7′6** Post 6d.

HOW FAR IS IT?

MEASURE THE DISTANCE of your rides with this handy little cyclometer. Easily attached and quite foolproof. Will prove quite indispensable to you.



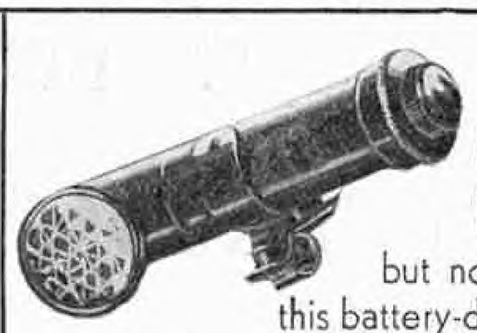
PRICE **3′6** Post 2d.

DON'T BE GONGED!

PRICE **12′6** Post 6d.



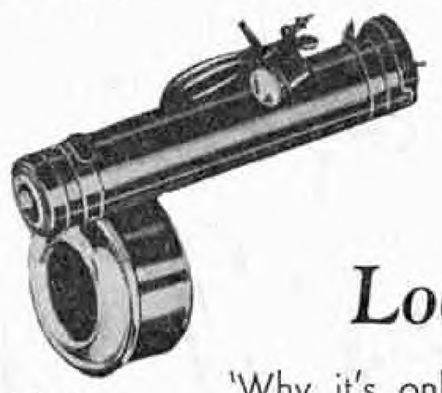
RECORD YOUR SPEED with this perfect speedometer which can be fitted so easily to your bike. Speeds up to 40 m.p.h. can be recorded! Buy one and see what your speed record is?



RED FOR DANGER

but not when you fit this battery-driven rear light. Will ensure your safety and give full and clear indication to cars passing you. You can ride in perfect safety with this attached. Strongly built.

PRICE **3′6** Post 3d.



Look out!

PRICE **7′8** Post 6d.

'Why it's only a bicycle! I thought it was a car! Get the 'Right of way' by fitting this fine electric horn which has an amazing volume of sound and can be heard above the noise of traffic. Worked by means of an electric battery.

ANYTHING ON THIS PAGE or any article in our catalogue can be obtained by return of post by sending a postal order for amount of price and postage.

Record in Roller Skates!



PRICE **7′6** Post 9d.

Super ball-bearing roller skates give you the smoothest journey you have ever had. Strongly finished, and of the highest quality. You can have hours of fun with them! Send for a pair to-day.

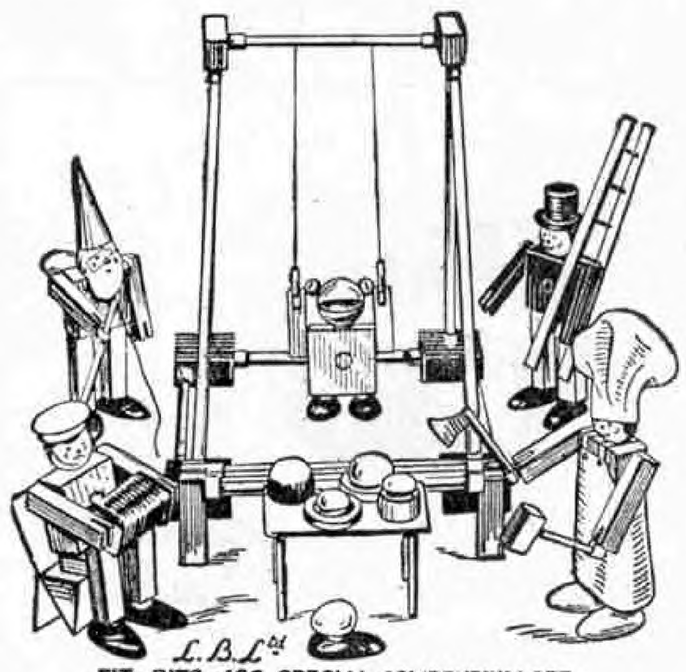


Important Message from the **FIT-BITS** Family

"We know we look funny and that people laugh at us! But we don't mind because that is the reason for which we were created. It's our job to bring hours of amusement and enjoyment to children everywhere.

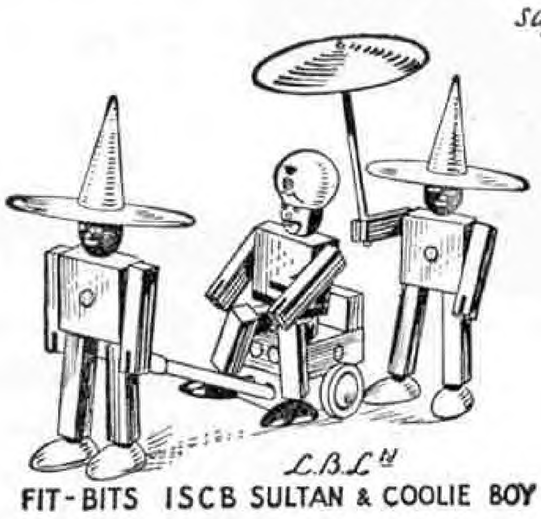
"We're a large family, too. Soldiers, sailors, circus folk, Red Indians, Five Merry Men, they're all here and all beautifully coloured! You've no idea what fun you can have fitting us together. Queer, fantastic figures and attitudes can be formed. We shall be a lasting source of fun to you. Hurry up and get a set of us and see for yourself!"

You FIT the BITS together with special patented safety rubber connections.



FIT-BITS 4SS SPECIAL COMPENDIUM SET

Price 12/6



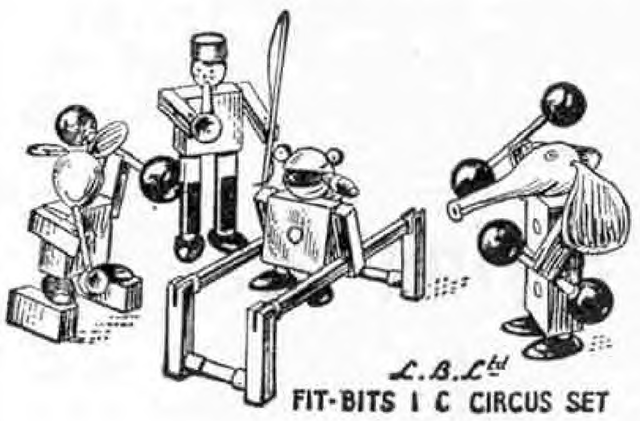
FIT-BITS 1SCB SULTAN & COOLIE BOY

Price 5/11



FIT-BITS 3MM FIVE MERRY MEN

Price 7/6



FIT-BITS 1 C CIRCUS SET

Price 6/11

FIT-BITS SETS

Obtainable at all good toy shops and stores from

1/11

TO DEALERS

AN EXTENSIVE ADVERTISING CAMPAIGN IS NOW BEING CARRIED OUT IN THE FOLLOWING JOURNALS:

'NURSERY WORLD,' 'PARENTS,' 'MOTHER,' 'MOTHER AND HOME,' 'TIME AND TIDE.'

BOOK YOUR ORDERS *NOW* AND MEET THE INCREASING DEMAND.

TRI-ANG

FIT-BITS

TRADE MARK

Patent pending in most countries.

MADE BY

LINES BROS. LTD., Tri-ang Works, LONDON, S.W.19.

GOING GOING GONE...



next week

5 PRIZES of £1·1·0

and

5 FOLDING KODAK CAMERAS will be

given by **Hercules** the makers of the highest quality Cycles to the winners of this Competition.

Who hasn't heard of Hercules—the modern cycle that everyone is riding, the smartest, smoothest-running machine on the road? And who hasn't heard of Hercules' offer to every boy and girl under 17? Send in the entry form *now* and get your scissors and paste ready for the simplest and most amusing competition you've ever heard of. There are brand new cameras and valuable cash prizes for the winners. Try to-day—but don't delay.

There's just time to fill this in – AND WIN!

ENTRY FORM Please send me details of the Hercules cycle competition. I understand this places me under no obligation.

NAME .....

ADDRESS .....

.....

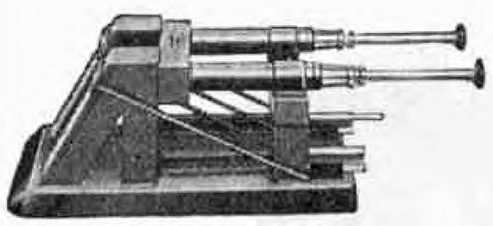
M.M. 1037

Go MODERN ...Go **Hercules**

THE HERCULES CYCLE & MOTOR CO., LTD., BRITANNIA WORKS, ASTON, BIRMINGHAM, 6

230

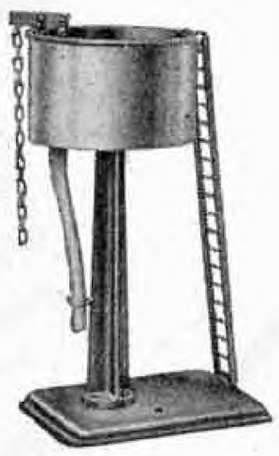
HORNBY ACCESSORIES



No. 2 BUFFER STOPS
Hydraulic type. Price **4/11**



No. 2 SIGNAL CABIN
Dimensions: Height 6½ in., width 3½ in., length 6½ in. Price **3/6**



No. 1 WATER TANK
Fitted with flexible tube and valve lever. Stands 6⅛ in. high. Price **2/6**

This page shows a few of the splendid range of accessories of the Hornby Railway system. See how realistic they are—all built in perfect proportion and all beautifully finished. Add some of them to your Hornby Railway and give it a realism that will be the envy of all your friends.

Ask your dealer to show you the complete range of Hornby Accessories.



No. 1 SIGNAL, DOUBLE ARM
Price **1/3**



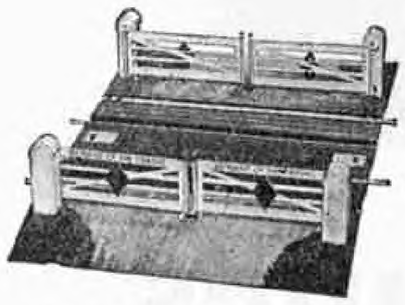
STATION OR FIELD HOARDING
Price **3d.**



No. 1 TUNNEL (STRAIGHT)
Base measurement:
Length 7 1/16 in., width 6¼ in.
Price **1/6**



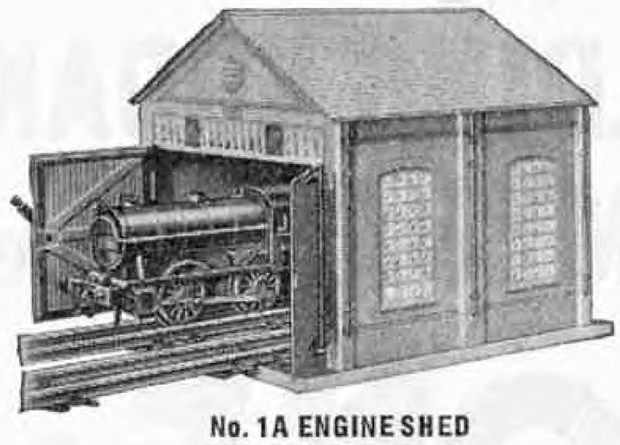
No. 2 LAMP STANDARD
Price **3/9**



No. 2 LEVEL CROSSING
Measures 13½ x 10¼ in., with two gauge O tracks in position.
Price **4/11**



No. 1 GOODS PLATFORM
Length 13 in., height 6¾ in., width 6 in. Price **5/11**



No. 1A ENGINE SHED
Price **9/11**

HORNBY RAILS, POINTS and CROSSINGS



EB1



ECR



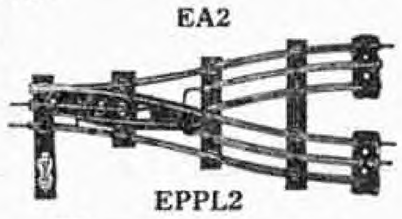
EA2½



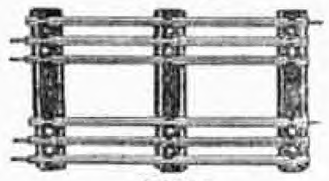
EB½



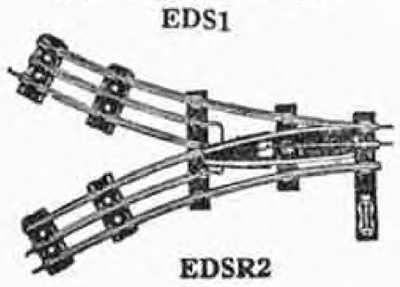
EA2



EPPL2



EDS1



EDSR2

GAUGE 0, 1¼". HORNBY SERIES.

Hornby Rails, Points and Crossings are built for hard wear and for smooth running.

There is practically no limit to the number of rail formations that can be built with them. Their adaptability is well shown in the booklets "How to Plan your Hornby Railway" and "Hornby Layouts–100 Suggestions," both of which may be obtained from your dealer, price 3d., or from Meccano Ltd., Binns Road, Liverpool 13, price 4d.

A SELECTION OF RAILS, POINTS AND CROSSINGS FOR ELECTRIC TRAINS

EB1 Straight rails ... ... per doz. 5/–
EB½ „ half rails ... „ „ 4/6
EA2½ Curved quarter rails (2 ft. radius) ... ... „ „ 4/–
EA2 Curved rails (2 ft. radius) „ „ 5/–
EPPR2 Parallel points, right-hand ... ... } per pair 7/–
EPPL2 Parallel points, left-hand ... ...
These points can be used with either 1 ft. or 2 ft. radius track.

EPR2 Right-hand points (2 ft. radius) ... ... } per pair 7/6
EPL2 Left-hand points (2 ft. radius) ... ...

EPR1 Right-hand points (1 ft. radius) ... ... } per pair 5/9
EPL1 Left-hand points (1 ft. radius) ... ...

EDS1 Straight rails, double track ... ... ½ doz. 8/6

EDSR2 Double symmetrical points, right-hand (2 ft. radius) ... ... } per pair 7/–
EDSL2 Double symmetrical points, left-hand (2 ft. radius) ... ...

EDSR1 Double symmetrical points, right-hand (1 ft. radius) ... ... } per pair 6/–
EDSL1 Double symmetrical points, left-hand (2 ft. radius) ... ...

FOR CLOCKWORK TRAINS

B1 Straight rails ... ... per doz. 3/6
A1 Curved rails (1 ft. radius) „ „ 3/6

PR1 Right-hand points (1 ft. radius) ... ... } per pair 3/–
PL1 Left-hand points (1 ft. radius) ... ...

PR2 Right-hand points (2 ft. radius) ... ... } per pair 3/–
PL2 Left-hand points (2 ft. radius) ... ...

CA2 Acute-angle crossings (for 2 ft. radius track) each 1/6

PPR2 Parallel points, right-hand ... ... } per pair 3/6
PPL2 Parallel points, left-hand ... ...
These points can be used for either 1 ft. or 2 ft. radius track.

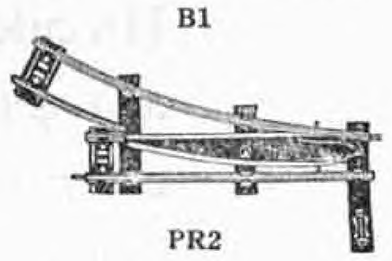
DC2 Curved rails, double track, 2 ft. radius only ... ½ doz. 6/–

Ask your dealer for an illustrated price list.

MECCANO LIMITED, Binns Road, Liverpool 13



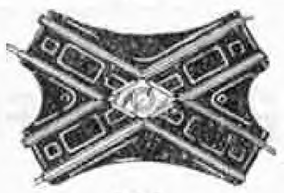
B1



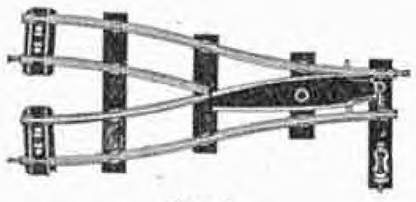
PR2



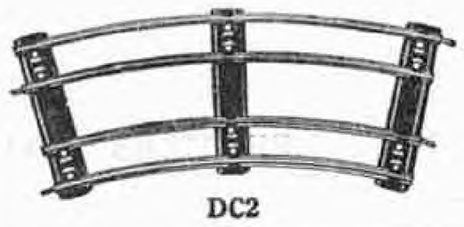
A2



CA2



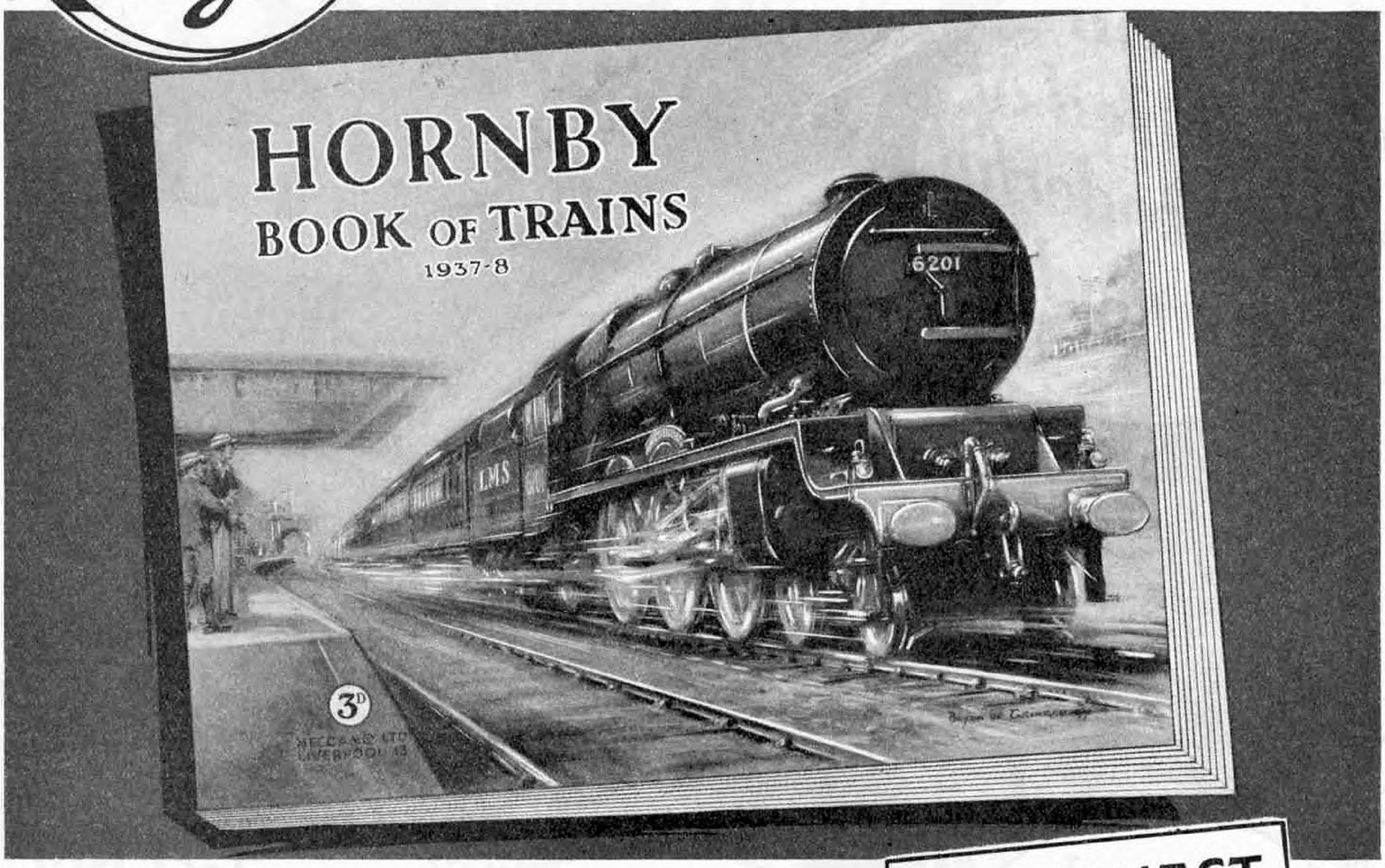
PPR2



DC2

Look Boys!

The 1937 HORNBY BOOK of TRAINS



Of absorbing interest to Railway enthusiasts

The 1937-8 issue of the Hornby Book of Trains is the finest that has ever been produced. It contains splendid articles, fully illustrated by photographs, dealing with British express trains and locomotives, the mysteries of an engine shed, the fascination of operating a miniature railway, and other interesting topics.

In addition the book forms a complete catalogue of Hornby Trains for electric and clockwork railways. All the Hornby Locomotives, Rolling Stock and Accessories are beautifully illustrated in full colour.

How to obtain the Book

The Hornby Book of Trains may be obtained from any Meccano dealer, price 3d., or direct from Meccano Ltd. (Dept. A.M.), Binns Road, Liverpool 13, price 4½d. post free. In the latter case a remittance in stamps should be sent and the name and address of the sender should be clearly written.

Readers living in Australia, New Zealand or South Africa who require copies should send their postal orders for 8d. (which includes postage) to the addresses given below. The Meccano Branch at Toronto will deal with Canadian orders and the price is 12 cents postpaid.

Readers living in countries other than those mentioned should order from Meccano Ltd., Binns Road, Liverpool 13, sending 6d. in stamps with their order.

Overseas Agencies:

AUSTRALIA: E. G. Page & Co., 52, Clarence St., Sydney (P.O. Box 1832k).
NEW ZEALAND: Models Limited, Paykel's Buildings, Anzac Avenue, Auckland C.1 (P.O. Box 129).
SOUTH AFRICA: Arthur E. Harris, 142, Market Street, Johannesburg (P.O. Box 1199).
CANADA: Meccano Ltd., 187-189, Church Street, Toronto.

Published by
MECCANO LTD. (Dept. A.M.), BINNS ROAD, LIVERPOOL 13

THE FINEST RAILWAY BOOK OF THE YEAR

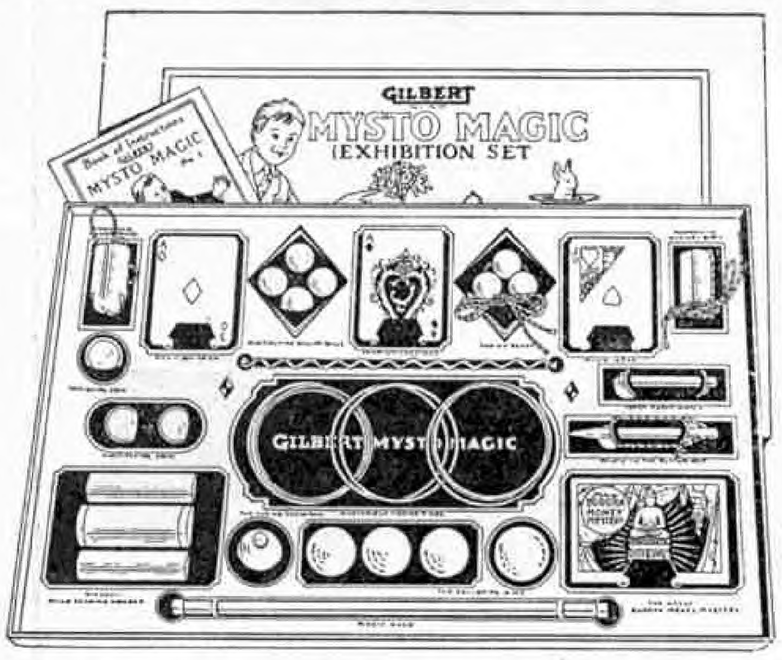
GET YOUR COPY TO-DAY

Price 3D.


Boys! You must see the NEW Meccano Manuals!
You will be amazed at the wonderful new models!
MECCANO
INSTRUCTIONS FOR No. 3 OUTFIT
New parts.. new designs.. new thrills!
Ask your dealer to show you the New Manuals- and the New Meccano
The world's greatest toy is waiting for you

There's never a dull moment with GILBERT TOYS

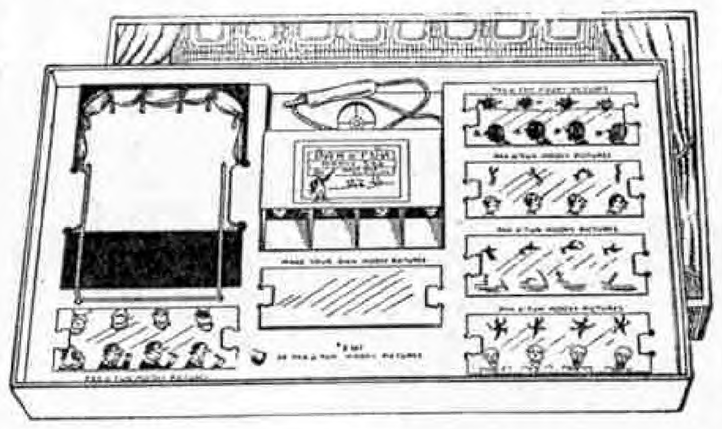
You'll be a lucky, happy chap when you are the proud possessor of a Gilbert toy! They're so exciting, they give such endless hours of healthy and instructive fun, they last so long! Now then, what's your choice? A movie show? A conjuring, chemistry or electrical set? A model-making outfit? A box of puzzles? We can't describe them **all** within the limits of this page—you'd better post the coupon below and we'll send you our complete catalogue.



BE A MAGICIAN!
Mysto Magic Conjuring

Astonish and mystify your family and friends with Gilbert Mysto Magic. Every set contains a large number of tricks and full instructions to enable you to become a skilful conjurer. The set illustrated contains 18 startling magic tricks, such as Multiplying Billiard Balls, Mysterious Linking Rings, Hiding Chessmen, Galloping Dime, Svengali, Mind-reading Wonder and many others. Prices from **5/-**
Other outfits: No. 3 (as illustrated), 10/6; No. 4, 12/6; No. 5, 21/-.

GIVE YOUR OWN MOVIE SHOWS



Gilbert Pak O'Fun Moovy Show

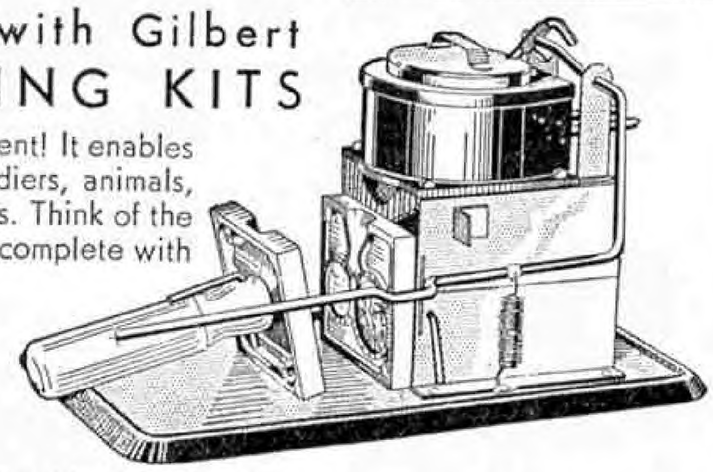
Think of having your own movies, and being able to make your own animated cartoons! This wonderful new toy erects like a miniature cinema and is quite simple to work, there being no complicated mechanism. The set is complete with a screen and twelve films, including blanks on which you can make your own moving pictures. It is electrically lighted and perfectly safe, using only torch batteries. Price **5/-**



Delve into Nature's Secrets
with Micro Chemistry

Have you ever thought of the thrilling discoveries you can make with a microscope?—and the amazing experiments you can do with a chemistry set? Gilbert Micro Chemistry combines these two fascinating hobbies! With the set illustrated, No. 7, the microscope magnifies 210 times and there are chemicals, apparatus and instructions for over 200 interesting, instructive experiments. Prices from **15/-**
Set No. 7 (as illustrated) 25/-. Also fine range of ordinary chemistry sets.

SOLDIERS! REDSKINS! TANKS! MOTOR CARS!
Make your own with Gilbert METAL CASTING KITS



Here is a toy that is really different! It enables you to make your own lead soldiers, animals, badges and dozens of other toys. Think of the fun it will give you. Each set is complete with moulds, bars of metal, paints for colouring finished toys, instructions and all necessary instruments. Simple and safe to use.
Prices from **7/6**
Set No. 3 (as illustrated) 15/-; Set No. 7, 30/-. Sets No. 3 and No. 7 are electric, 200/250 v. A.C. or D.C.



Additional moulds and "pigs" of metal can be bought separately.

Gilbert ELECTRIC Hand Drill



If you are keen on model building, carpentry, etc., you should certainly get this electric drill. It saves hours of tiring hand drilling and ensures a perfect job. Easy to use. Operates on A.C. or D.C. current. Can also be used for buffing, burnishing, etc. Complete with switch, chuck and flex, price **27/6**

COUPON

Cut out and post to:
The A. C. Gilbert Co., 109, Kingsway, London, W.C.2

M.I.

Please send me your catalogue describing all the latest Gilbert toys.

NAME.....

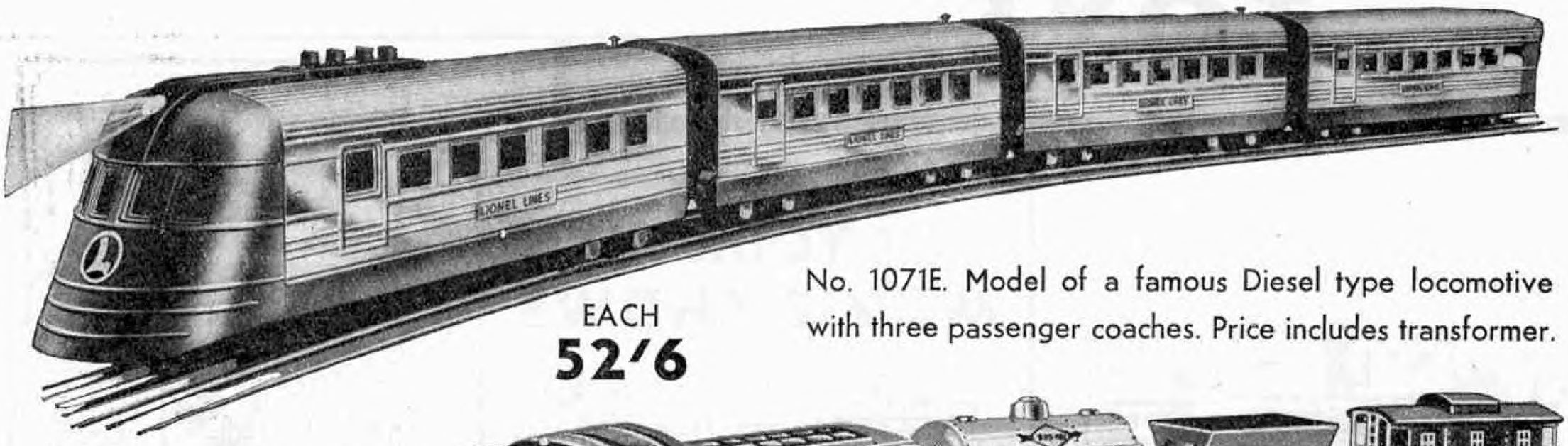
ADDRESS.....

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LIONEL ELECTRIC TRAINS

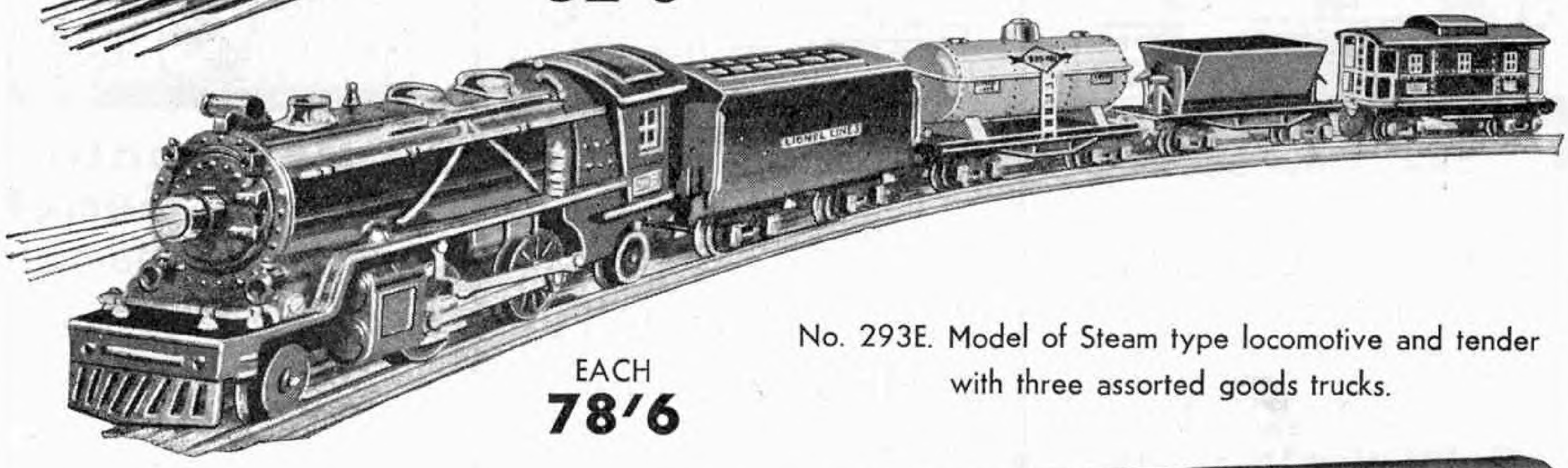
MADE IN U.S.A.

LOOK AT THESE WONDERFUL NEW **LIONEL** MODELS, WHISTLING, REVERSING, SWITCHING BY REMOTE CONTROL



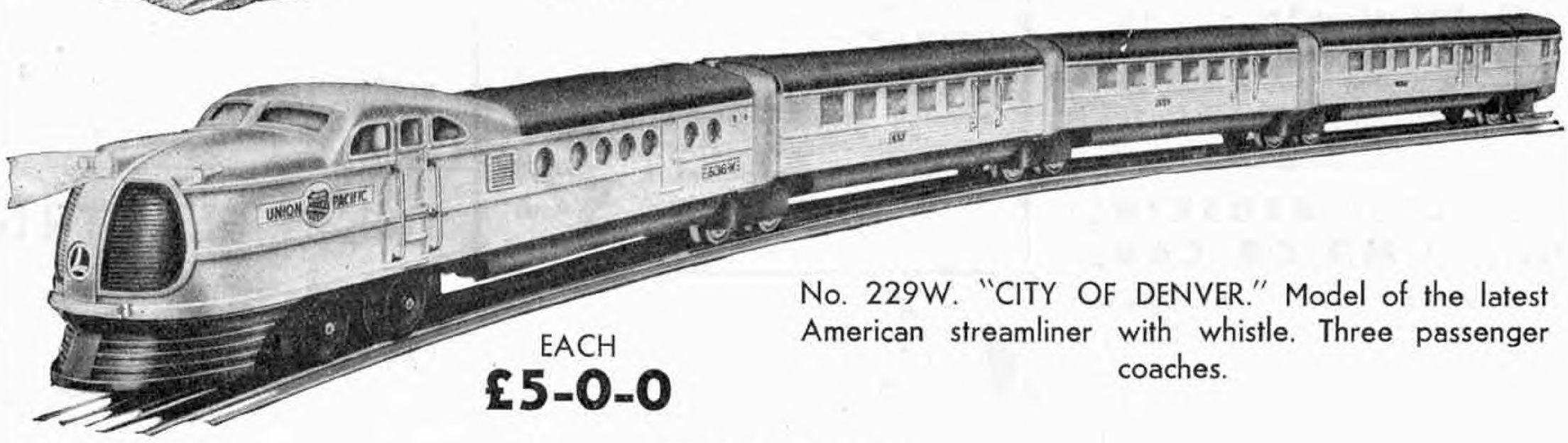
EACH
52′6

No. 1071E. Model of a famous Diesel type locomotive with three passenger coaches. Price includes transformer.



EACH
78′6

No. 293E. Model of Steam type locomotive and tender with three assorted goods trucks.



EACH
£5-0-0

No. 229W. "CITY OF DENVER." Model of the latest American streamliner with whistle. Three passenger coaches.

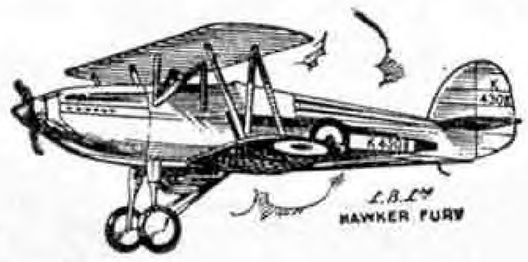
FREE

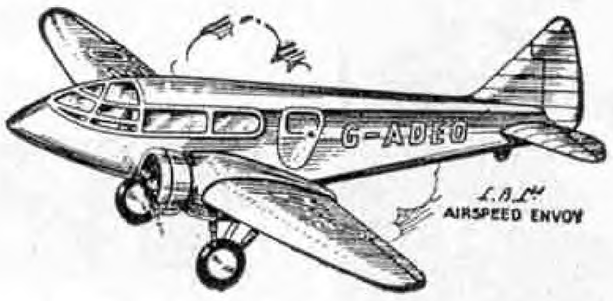
Write for Beautifully Illustrated Catalogue of Steam Type Trains and many other fine Models.

To **LIONEL SERVICE DEPT. (17)**

35′36, Aldermanbury, LONDON, E.C.2

Build these realistic scale-models

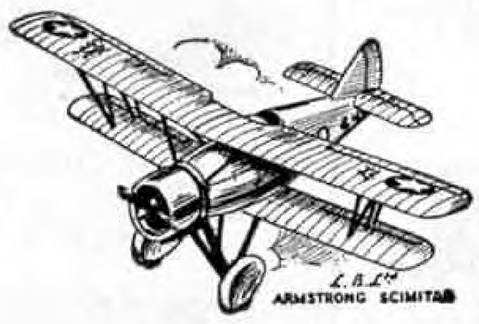


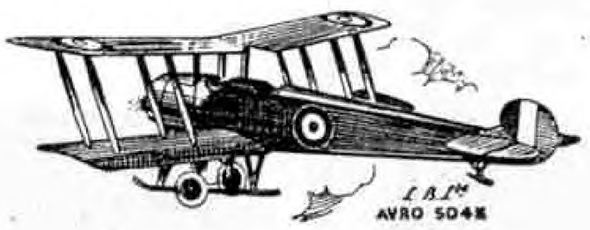


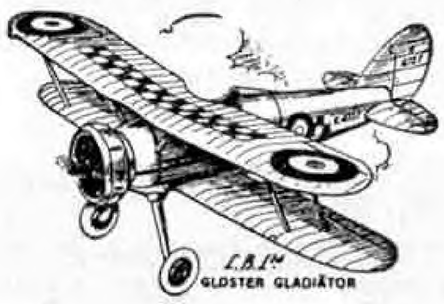
PRICES OF CONSTRUCTION KITS

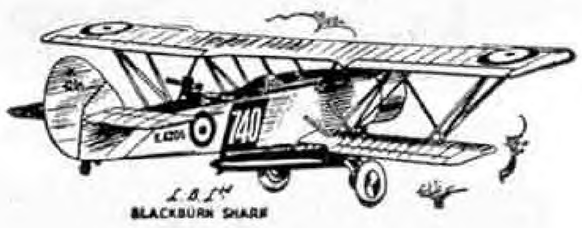
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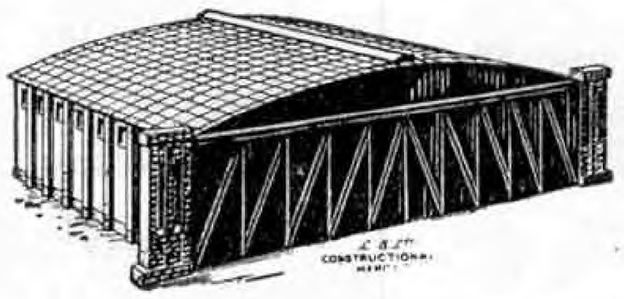












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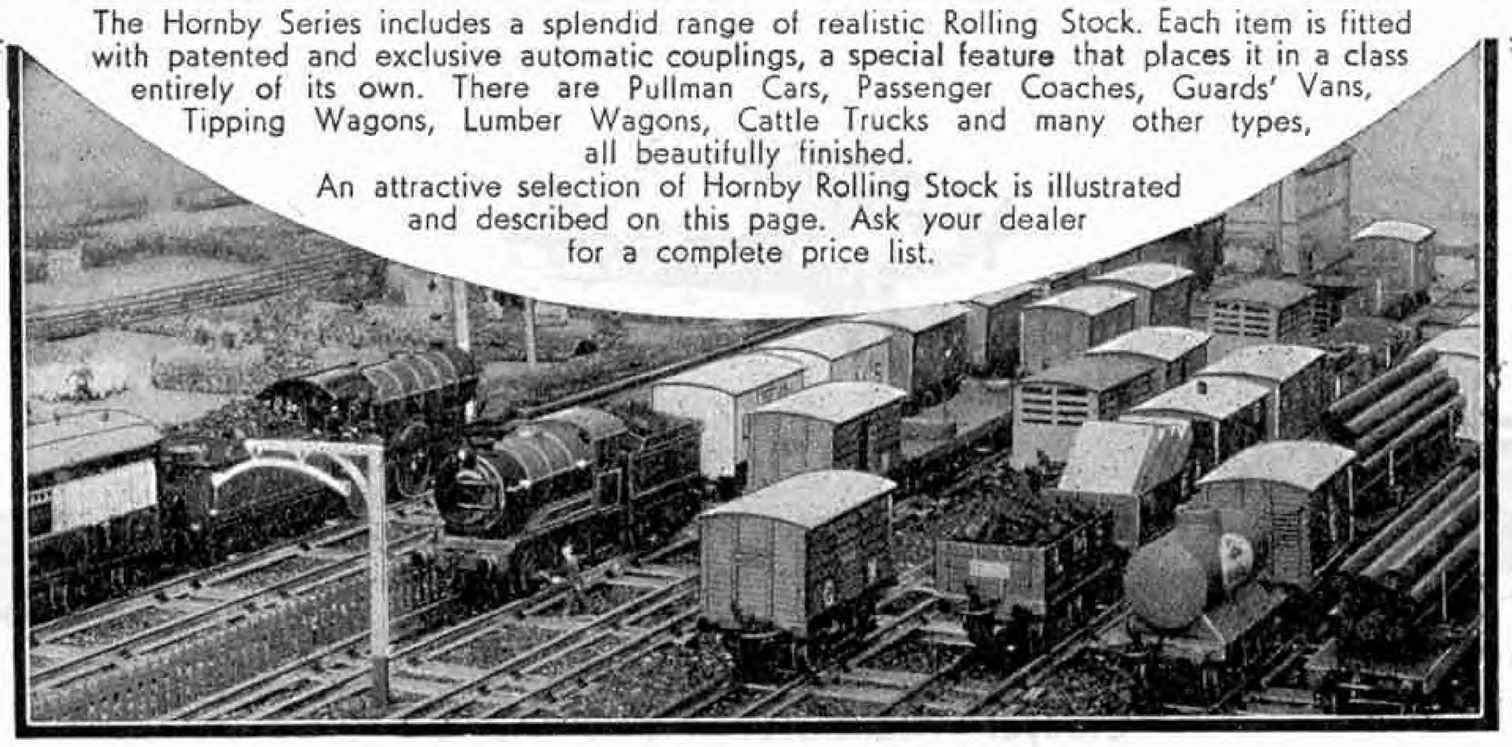
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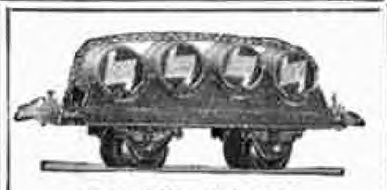
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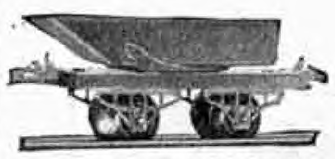
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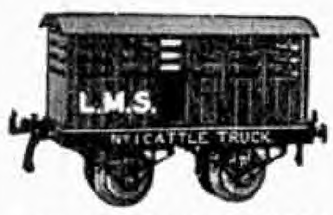




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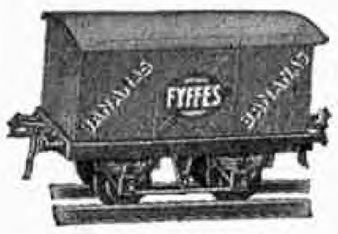
OIL TANK WAGON "ROYAL DAYLIGHT"
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No. 1 PETROL TANK WAGON "ESSO"
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BITUMEN TANK WAGON "COLAS"
Finished in blue.
Price **3/6**

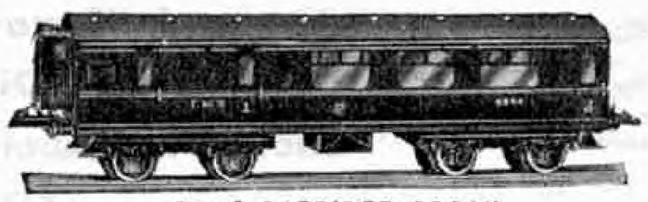


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Sliding doors
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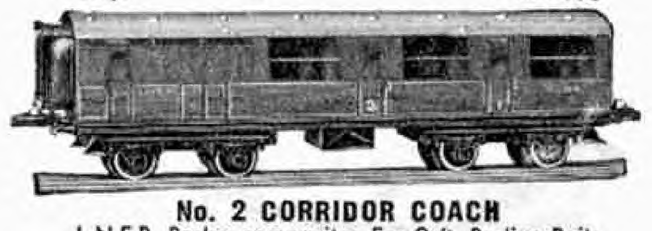
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L.M.S. First-third. For 2 ft. Radius Rails only.
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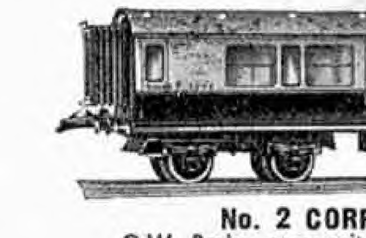
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No. 2 HIGH CAPACITY WAGON
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***No. 0 WAGON**
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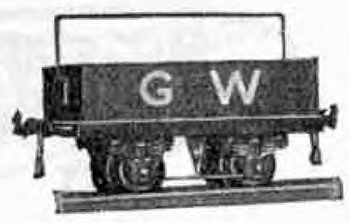


No. 1 CRANE TRUCK
Finished in brown and blue.
Price **2/3**

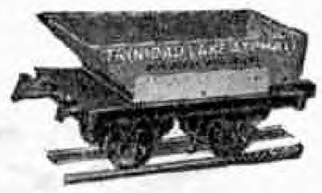
*In L.M.S., N.E., G.W. or S.R. Lettering.



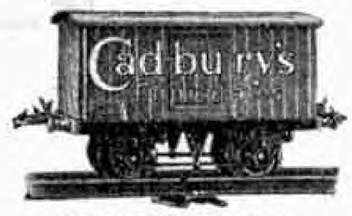
GAS CYLINDER WAGON
Finished in red. Lettered gold.
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***OPEN WAGON "B"**
Fitted with centre tarpaulin-supporting rail.
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No. 1 ROTARY TIPPING WAGON
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CHOCOLATE VAN "CADBURY'S"
This van is beautifully enamelled in blue with white roof.
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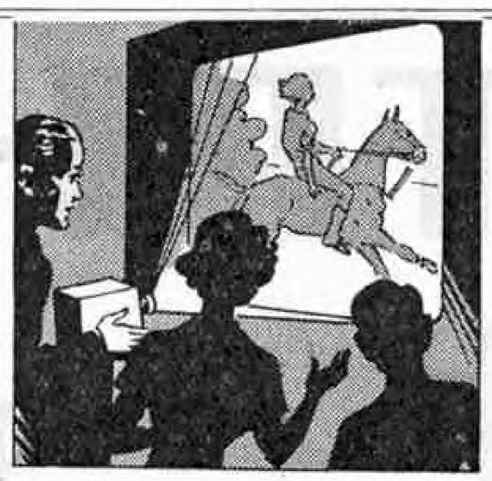
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The door at the top opens. Finished in bright yellow.
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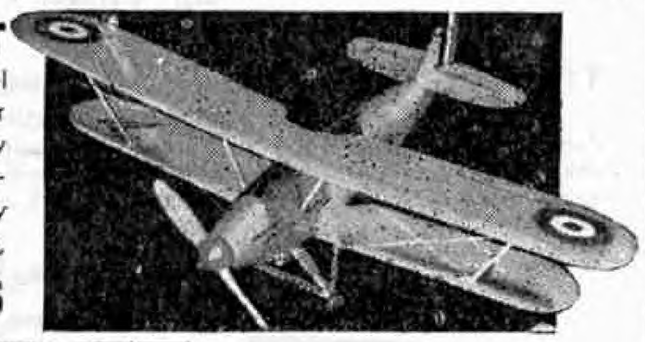
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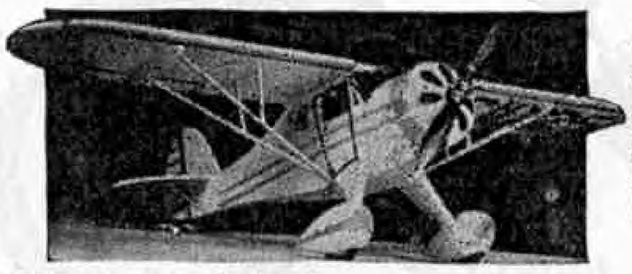
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SPAD

Wingspan 6½ ins. Fine model of Great War fighter. Full size plan shows every detail. Complete kit has all parts needed, wood ready cut to outline, die cast prop and Vickers gun, cement, lacquers, etc.

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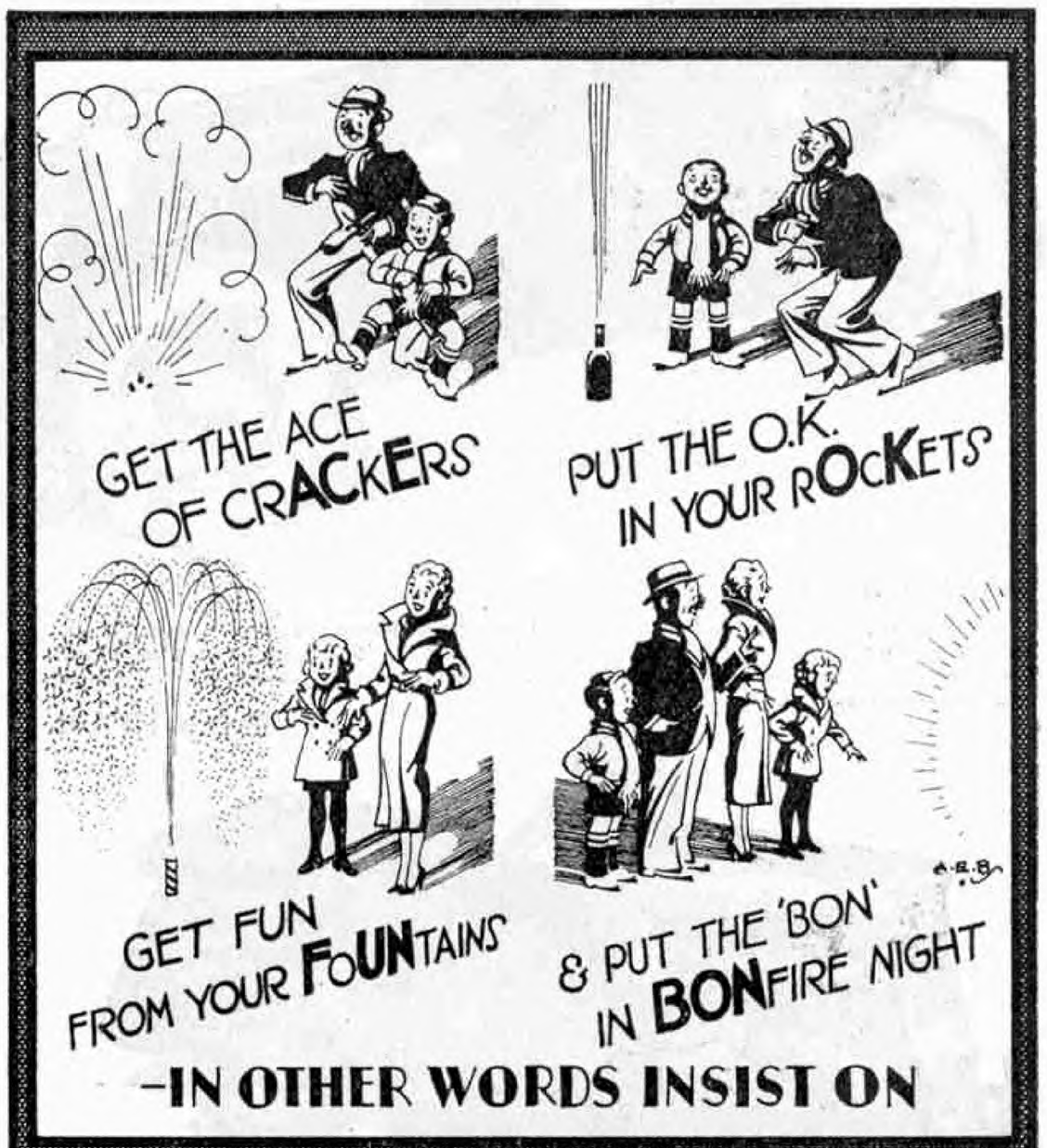
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Wingspan 8 ins. Very smart model of American civil plane. Full size plan shows all details. Kit is complete with all parts needed, wood, lacquer, etc.

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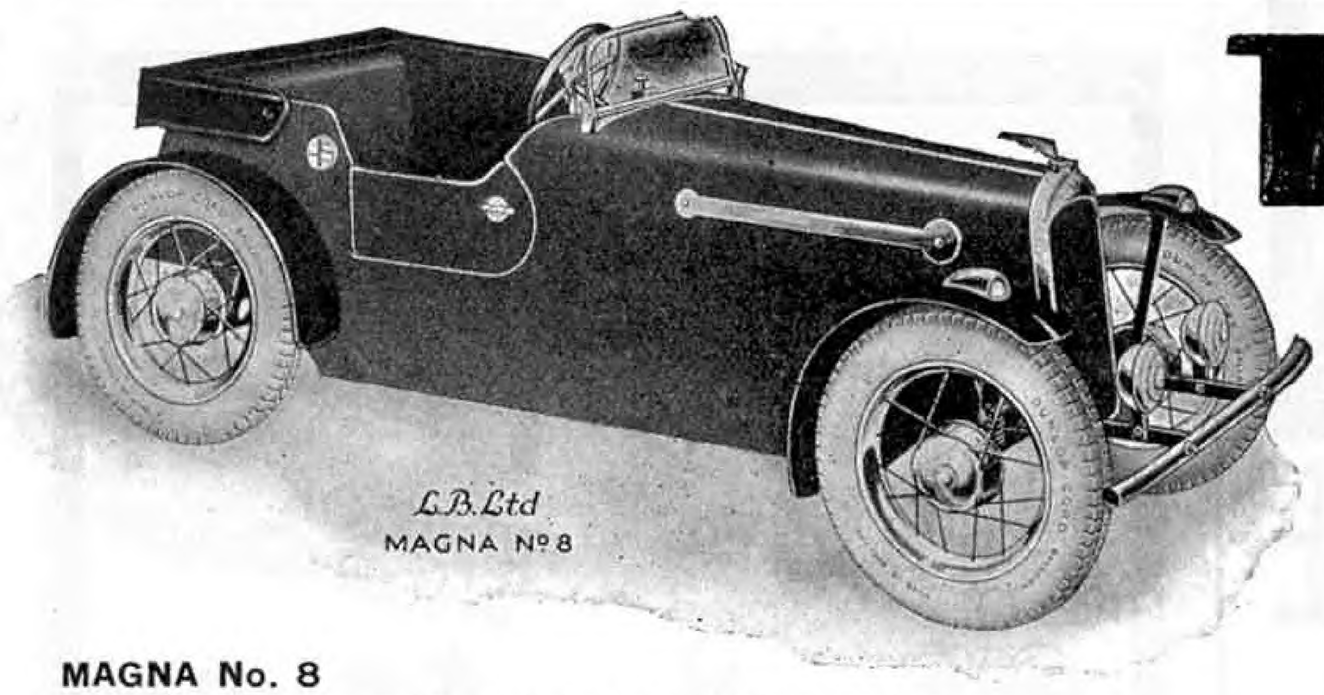
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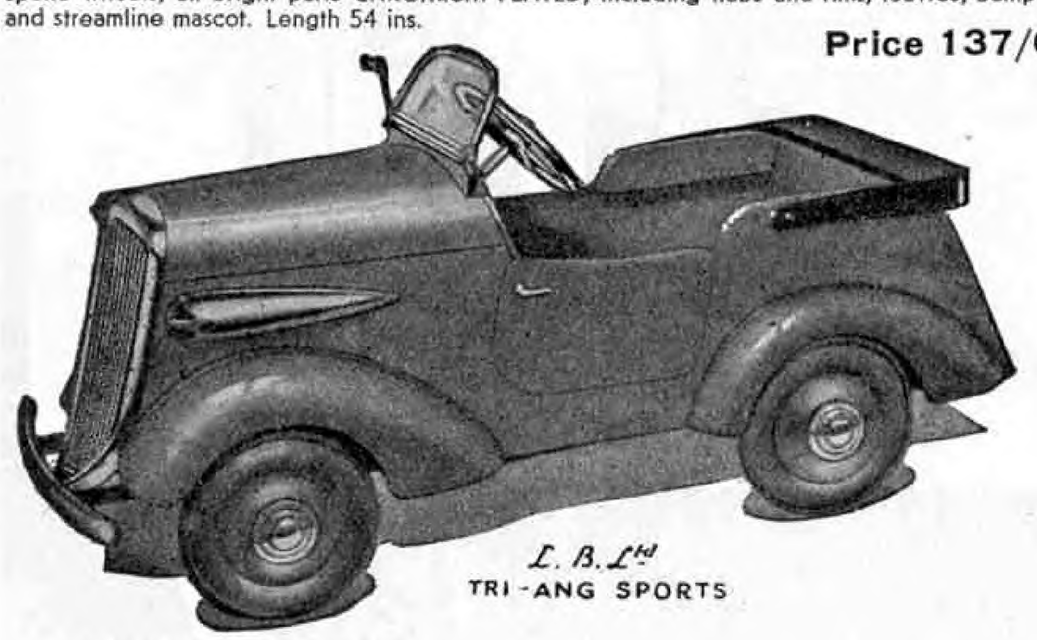
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A magnificent sporting car, coach-built body, fully sprung, ball-bearing back axle, opening side door, windscreen, dummy hood and lamps, tubular bumper, Dunlop pneumatic tyres on tangent spoke wheels, all bright parts CHROMIUM PLATED, including hubs and rims, louvres, bumper and streamline mascot. Length 54 ins.

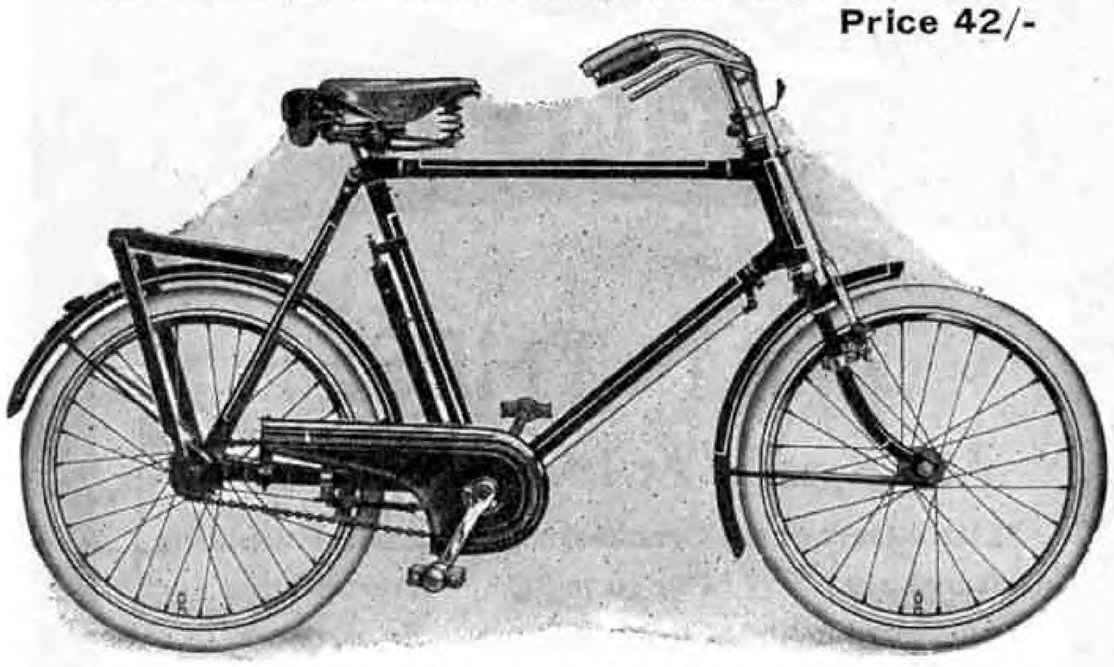
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TRI-ANG SPORTS

Realistic streamlined model, with opening side door and luggage boot. 8 in. balloon disc wheels. ¾ in. rubber tyres. Ball-bearing back axle. Plated bumper and streamline dummy side lamps. Windscreen, direction indicator and dummy hood. Length 41 in.

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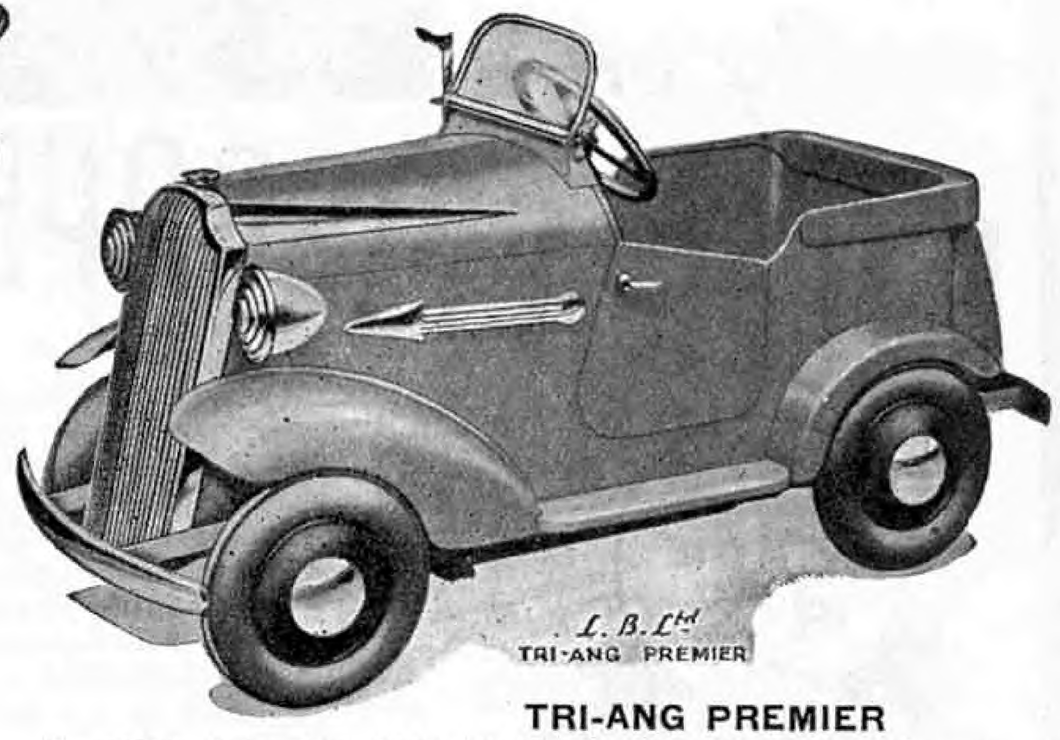
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Tubular frame. 14 in. wheels. 1⅜ in. grey imitation pneumatic tyres. Ball-bearing pedals. Rim brake. Two-coil saddle. Chain cover. Stand. CHROMIUM-PLATED FITTINGS. Black, blue or maroon.

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NEXT MONTH: "THE MAKING OF STEEL." PUBLISHING DATE: 1st NOVEMBER

MECCANO MAGAZINE

Editorial Office:
Binns Road, Liverpool 13
England

Vol. XXII. No. 10
October, 1937

With the Editor

Our Twenty-First Birthday

The reminder, on this page last month, of the approaching twenty-first birthday of the *"M.M."* has already brought me letters of congratulation from a very wide circle of readers. Many of these letters are so interesting that I wish I could find space to reproduce them. The writers look back over the many years during which they have been regular readers of the *"M.M.,"* and recall the keen interest with which they have watched the steady growth of the Magazine, both in quality and quantity.

I wonder how many readers have taken the *"M.M."* from its first issue? So far only one has written to me, Mr. Bertram E. Ward, of Sparkbrook, Birmingham 11. He writes on 4th September: "When reading the current number of your wonderful Magazine I feel strangely aged and elated. Is a reader and a possessor of every copy since the eventful September–October 1916 a record? Although business hinders my fetching out my No. 5 Outfit, also aged, your paper keeps me in touch with model-making, and the instruction and general knowledge derived from your pages is a great help to me, as no doubt it is to countless others. The heartiest of congratulations to you and your paper." I should particularly like to hear from any other readers who can equal Mr. Ward's record, or who have recollections of interest in connection with the early issue of the *"M.M."*

As soon as possible I will answer personally all letters of congratulation. In the meantime I send my sincere thanks to all who have sent good wishes, and I assure them that I intend to do everything in my power to make the *"M.M.,"* in future, better than ever!

Engineering Research

It has always been a matter of great wonder to me how the early engineers tackled successfully so many big jobs, without previous experience or training. Take, for instance, James Brindley. The only training he received was during his apprenticeship to a local and very incompetent millwright, and his general education was practically nil. To the end of his life he wrote only with the greatest difficulty, and almost illegibly, and his spelling was absolutely weird. Yet this man conceived the idea of the Barton Aqueduct, to carry the Duke of Bridgewater's Canal over the River Irwell, and in spite of all criticism boldly and successfully tackled its construction.

The achievements of Brindley, Telford and others were remarkable individual efforts of men of peculiar genius, and engineering could not have developed to its present extent without a widespread increase in knowledge resulting from organised research. This fact was emphasised by the prominent engineer Sir Alexander Gibb, F.R.S., in his presidential address to a section of the British Association at Nottingham. He quoted the words of Sir William Anderson in 1893: "The days are past when an engineer can acquit himself respectably by the aid of mother wit alone, or of those constructive instincts which in the past led our predecessors to such brilliant results."

Sir Alexander drew attention to the fact that to-day in this country, and in America, Germany and elsewhere, engineering research is being carried out on a vast scale by Government Departments, Universities and similar institutions. In this manner problems are being rapidly solved, and a growing mass of information prepared to form the foundation on which engineers of the future will build.

Saving the Whale from Extinction

This month 33 factory ships and 232 catchers will leave for the whaling grounds in the Antarctic. For the next six months they will stay in the icy waters on the edge of the pack ice, and it is expected that during that time their 11,000 men will capture and deal with about 30,000 whales. This great invasion takes place in seas that only 25 years ago were practically deserted. A few whalers were then working in Antarctic seas, chiefly from South Georgia and other islands in the far south of the Atlantic Ocean, but apart from them the only visitors were famous explorers such as Scott, Shackleton and Amundsen.

There is an unpleasant side to the modern scientific pursuit of whales, in which harpoon guns and wireless play important parts. Formerly the seas literally abounded with these creatures, but to-day there is a grave risk of their extinction. There is a close season, fixed by an international convention, but it almost seems as if a kind of National Park of the seas will have to be created somewhere in the Antarctic in which the whale can remain immune from pursuit, if the creature is to be preserved.

The danger of the disappearance of the whale is fully realised, and efforts are being made to learn as much as possible about its haunts and habits, in order to do what is possible to prevent its complete destruction. This information is being collected by the Royal research ship *"William Scoresby,"* which left the Thames in September and proceeded to the Antarctic on her seventh cruise. This vessel departed before the whaling fleet so that whales can be marked before they are caught. Records will be kept of the places where the marking is done, and thus the movements of the whales will be traced.

The "M.M." Comes of Age

Birthday Messages from Famous People

By The Editor

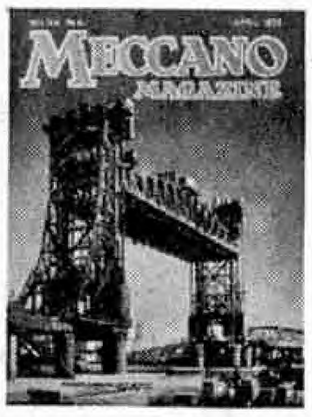


TWENTY-ONE years ago there appeared the first number of the "*Meccano Magazine*," consisting of four pages and issued free. It was produced as a direct result of a widespread demand from Meccano model-building enthusiasts for a paper to help them to get more out of their hobby. The first few issues were devoted entirely to model-building. Then, in response to urgent requests, illustrations and descriptions of actual engines and machinery were introduced, and these met with a surprisingly warm welcome. Gradually the scope of these special articles was extended, and soon it became evident that there were large numbers of boys keenly anxious to know more about the interesting things in the world around them, and having little desire for sensational fiction.

Thus there came into being the idea of a magazine published entirely in the interests of boys, and devoted to engineering, railways, ships, aviation, and general science. No time was lost in converting this idea into a reality, and the "*Meccano Magazine*" has grown slowly but surely to a position of unique importance and influence. In twenty-one years the four-page paper has become a magazine with a minimum of 80 pages, rising to 120 pages or more for the December issue.

At one time well-wishers of the Magazine urged that school and adventure stories should be included. No boys' paper, they said, had ever succeeded or could succeed without such stories. The "*Meccano Magazine*" has proved this view to be completely wrong. Emeritus Professor H. S. Hele-Shaw, D.Sc., LL.D., M.Eng., M.Inst.C.E., F.R.S., Past President of the Institution of Mechanical Engineers, writing to me with reference to the coming of age of the Magazine, says: "Seventy years or so ago I bought for the sum of one penny the first number of a boys' paper. The contents of that production were entirely devoted to adventures by sea and land of various heroes of twelve or thirteen years. In particular I remember a pirate story, in one scene of which a boy in shirt and shorts, both ragged, was in a cave surrounded by bloodthirsty ruffians armed with daggers or cutlasses! Alas, there was nothing in this paper about the things on which I was keen—model trains and model boats—and indeed nothing to interest a keen, alert-minded lad. To-day the "*Meccano Magazine*" provides all a boy could wish; and I know that scores of my young friends look forward to each issue far more eagerly than the boys of 70 years ago anticipated the next instalment of their pirate yarn."

Another interesting message emphasising the contrast between past and present comes from Sir William S. Crawford, K.B.E., Chairman and Governing Director of the well-known firm of advertising agents, W. S. Crawford Limited. Sir William writes:



"Looking through the '*Meccano Magazine*' the other day I realised that the modern boy is an extremely lucky young man. In my school days, outside the normal curriculum, a boy had to pick up his general knowledge with very little help. And although engineering and science in those days were subjects of interest to most boys, there were few sources of information which an intelligent boy with an enquiring mind could draw on with any regularity.

"Now things are different—and in my opinion your Magazine has done great work. It must have helped thousands of boys in choosing a hobby, taught them to concentrate and create for themselves, and in many cases, no doubt, been the inspiration for an engineering career.

"I notice, too, how admirably your articles are mixed. In one you give a full account of how a new railway is planned; in another, you show the boy how he himself, with very simple laboratory equipment, may experiment in such modern industrial chemistry as the tanning of raw skins. Such hobbies develop the young mind and teach it to develop itself. No boy should ever be bored with a '*Meccano Magazine*' in his house. And all parents should see that he has the Magazine every month. Apart from the creative instinct which such a magazine promotes, it provides a groundwork of general information on modern industrial development which, when he goes to work, will help any boy greatly, whatever his career.



Dr. H. S. Hele-Shaw, F.R.S.

"Go on with your splendid publication. You render a national service worthy of your great House. The benefits may be unseen, but yet they are real and lasting."

Railway articles and news have always been a prominent feature of the "*M.M.*," and their popularity has increased year by year. Indeed, if I carried out the demands made by railway enthusiasts there would be room for little else! For this reason I greatly appreciate the following message from Sir Josiah Stamp, G.C.B., G.B.E., Chairman and President of the Executive, London Midland and Scottish Railway: "It gives me great pleasure to add my congratulations to the many others you will no doubt have received on the occasion of the twenty-first birthday of the '*Meccano Magazine.*' I sincerely hope that this paper has an even longer period of service before it, in presenting to the younger generation in an interesting



manner free from sensationalism the latest developments in all branches of transport and engineering science. Among journals catering for boys of all ages, the '*Meccano Magazine*' has established by sheer merit a unique position, and it is good to see that its varied contents include so high a proportion of matter relating to railways, thus supporting my own contention that in this age of scientific wonders, railways and locomotives still hold pride of place in interest, fascination and progress."

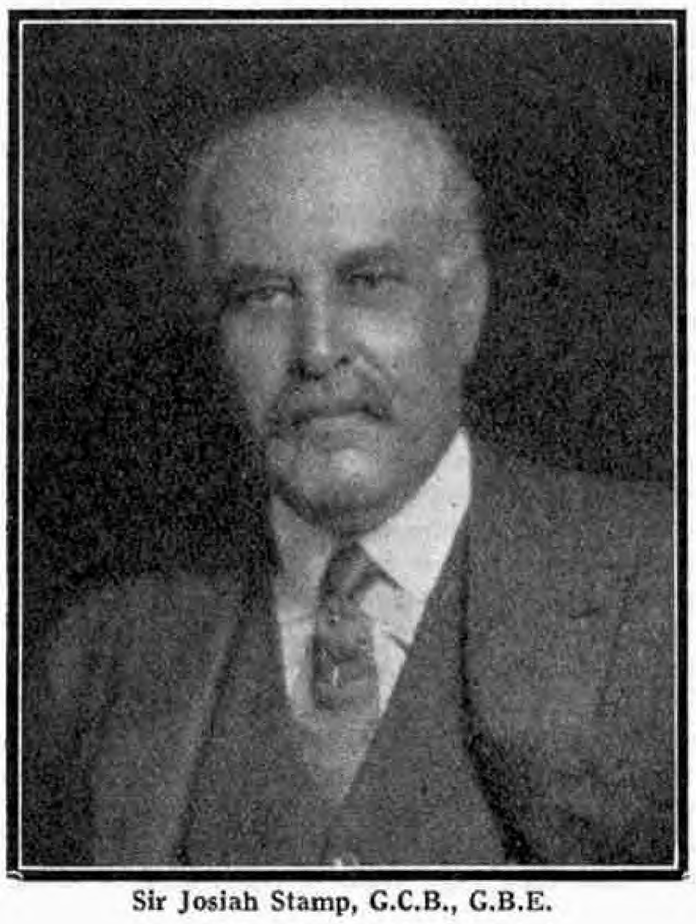
Vastly encouraging too is a message from an engineer whose name is known and honoured wherever railways are spoken of—Sir Nigel Gresley, C.B.E., D.Sc., M.Inst.C.E., M.I.Mech.E., Chief Mechanical Engineer, London and North Eastern Railway: "I congratulate the '*Meccano Magazine*' on attaining its majority. Its popularity with boys, young and old, is well deserved, and I trust it may long continue to provide its readers with accurate and interesting information regarding railway activities."

From Mr. R. G. Woodward, Director of the world-famous Sheffield steel firm Edgar Allen and Company Limited, comes the following letter of congratulation: "The celebration by the '*Meccano Magazine*' of its 21st birthday gives us the pleasant privilege of expressing our congratulations on this remarkable achievement of a journal of unique character. For many years we have interchanged with you our technical journal, the '*Edgar Allen News*,' and if the latter has been read by you with the interest with which your journal has been read by us, we shall feel more than gratified. Our experience is that although young people form a large percentage of the readers of the '*Meccano Magazine*,' it is the adults who pounce upon it first, because the material it contains cannot but be of interest to every male with engineering knowledge, or even without it. The 21st anniversary of the '*Edgar Allen News*' will not occur for another two or three years, so that we must rank as your juniors in magazine publication; but we hope you will accept our congratulations and best wishes for the future success of your publication."



Sir Nigel Gresley, C.B.E.

The aviation section of the Magazine has always been regarded as of special importance. From the first the object of this section has been to create among readers the "air-mindedness" that is necessary if air transport is to reach its fullest development. When civil aviation began to emerge from the confused aftermath of war-time flying, there was an urgent need for reliable information about aircraft in a form that would arouse and maintain the interest of the boys who would form the first generation of civil pilots.



Sir Josiah Stamp, G.C.B., G.B.E.



Sir William Crawford, K.B.E.

This need the Magazine set out to supply, in the form of articles describing the latest developments in aircraft and their engines. In all these articles the guiding principle has been to combine accurate technical detail with a style of writing that would attract boys by its simplicity and readableness. The aircraft manufacturers, both British and foreign, have assisted splendidly with information and photographs, and have repeatedly expressed their appreciation of the accurate and efficient manner in which their products have been described. Imperial Airways, too, have from the first been most friendly and helpful.

The efforts of the Magazine in arousing interest in flying have been warmly approved by Sir Alan Cobham and other prominent men in the world of aviation. I was particularly glad to receive this message from Mr. C. G. Grey, Editor of "*The Aeroplane*," in view of the candid comments he has repeatedly made on inaccurate and misleading information in certain papers: "I consider the '*Meccano Magazine*' one of the most valuable assets in this country to the proper upbringing of children and their education in things mechanical, using the word education in its proper sense, not merely to indicate instruction, but rather the bringing out of their natural ability. I have always particularly admired the way in which it has handled aeronautical affairs. It has, particularly, maintained a high level of technical accuracy. I am very glad, and not at all surprised, to hear that the aviation pages are among the most popular sections of the Magazine."



Ships and shipping news form yet another regular feature of the Magazine, and one that is being extended in view of its popularity. Readers who are keen on ships will be interested in a message from Captain J. C. Townley, R.D., R.N.R., who has commanded such famous Cunard liners as the "*Berengaria*," "*Aquitania*," "*Franconia*," "*Lancastria*," "*Carmania*" and "*Georgic*," and who recently, during the illness of Captain R. V. Peel, commanded the "*Queen Mary*." "My heartiest congratulations to the '*Meccano Magazine*" on attaining its twenty-first anniversary. May your very excellent publication continue to provide pleasure to your readers, both young and old, for many years to come."

Twenty-One Years of Bridge Building

An Era of Wonderful Progress

THE lifetime of the "*Meccano Magazine*" has seen the building of many great bridges that not long ago would have been regarded as impossible and fantastic. At the time when the first issue of the "*M.M.*" appeared, 21 years ago, there were two bridges of outstanding interest and importance under construction. One of these was the Quebec Bridge in Canada, which was being erected across the St. Lawrence, linking the provinces to the east of the river with the rest of the Dominion. This is a magnificent example of the cantilever bridge. Its main span of 1,800 ft. is the largest of its type in the world, and exceeds in length the spans of the Forth Bridge, the most famous of all cantilever bridges. The Forth Bridge is still the longest cantilever structure in the world, however. The total length of its three double cantilevers with their intervening suspended spans is 5,349 ft., or more than a mile, and the two central openings they form are each 1,710 ft. long.

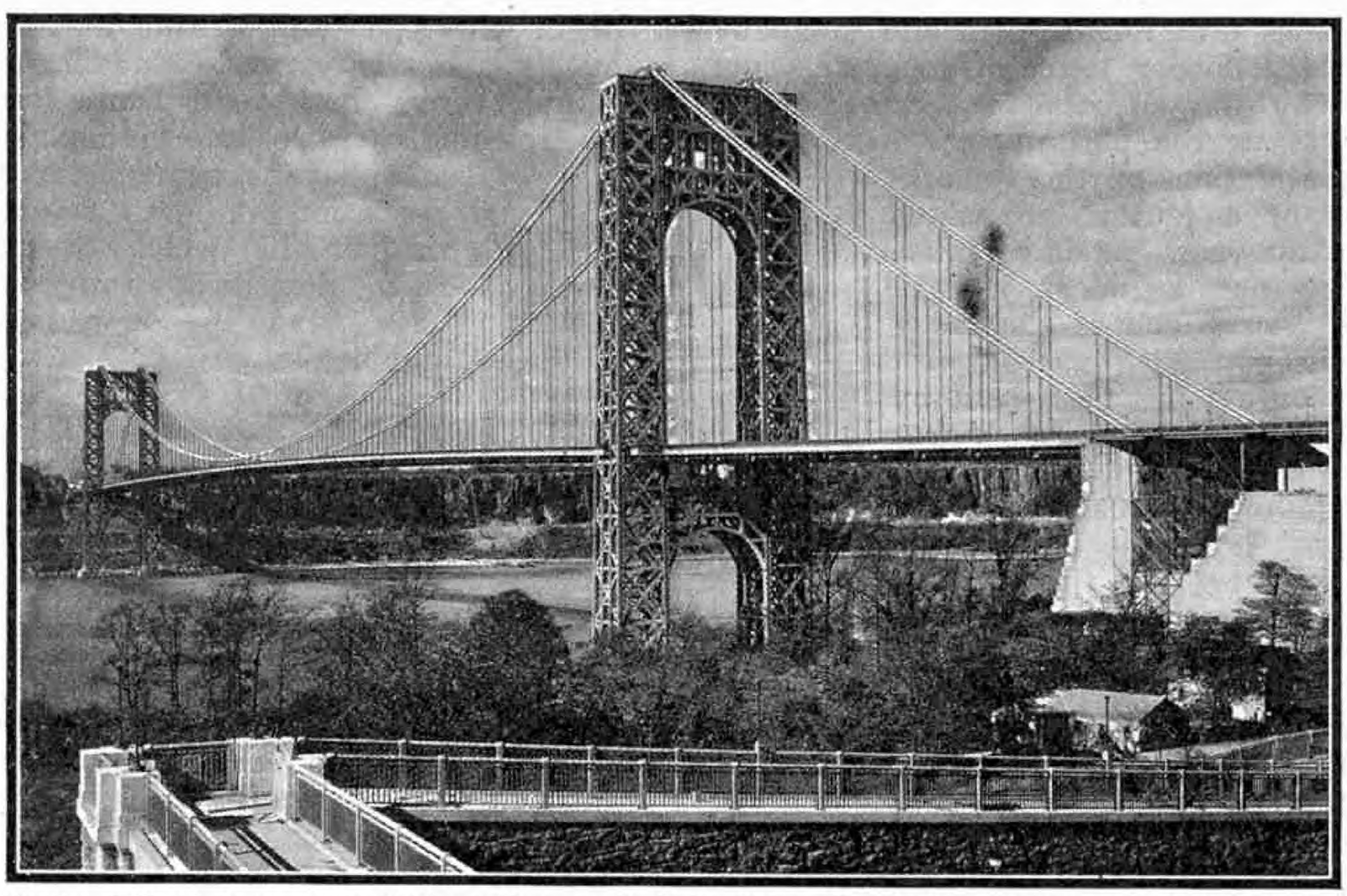
The second great bridge under construction in 1916 was the Hell Gate Bridge in the United States. This crosses the East River at New York and its steel arch, with a span of 977 ft. 6 in., remained the longest of its type for 14 years after its completion in 1917.

The Hell Gate Bridge is a splendid example of the work of American engineers, who have long been famous for their bridge-building achievements. It was they who developed the suspension bridge to its present position, and to-day structures of this type span great rivers and arms of the sea that not long ago seemed as if they would remain unbridged for ever. Many wonderful suspension bridges had been built in America before 1916, among them three outstanding structures at New York. Of these the Williamsburg Bridge, completed in 1903, has a span of 1,600 ft. All are magnificent structures, but during the last 21 years they have been completely dwarfed by gigantic bridges of the same type built in various parts of the United States.

The first of this succession of great suspension bridges was the Camden Bridge, which crosses the Delaware River at Philadelphia. It was completed in 1926, and its span of 1,750 ft. easily exceeded the previous record of the Williamsburg bridge for spans of this type. Two years later came the Ambassador Bridge, with a span of 1,850 ft., linking Canada and the United States across the Detroit River, and this in turn was surpassed by the George Washington Bridge at New York, which was completed in 1931. This magnificent structure is shown in the illustration on this page. It crosses the Hudson River in a single span of 3,500 ft., which for several years remained the longest in the world, and has an overall length of 4,760 ft. The towers supporting its great cables rise to a height of 635 ft. above the water, and the deck of the bridge gives a clearance of 213 ft. About 100,000 tons of steel were required for its construction, and the anchorage built on the New York side to resist the pull of the cables of the bridge consists of a great mass of concrete weighing 370,000 tons.

Now even this enormous bridge has been surpassed by two others of the same type that have recently been completed at San Francisco. One of them forms part of a stupendous structure, with a total length of seven miles, that crosses San Francisco Bay to Oakland. The bridge is divided into two sections by Goat Island, in the middle of the Bay, and the part connecting the island with San Francisco consists of two suspension bridges built end to end, each with a main span of 2,310 ft. The total length of this section is 10,450 ft. The two bridges have a common anchorage in the middle of the waterway. This is an immense block of concrete 197 ft. long and 92 ft. wide, with a height equal to that of a 40-storey building. It rests on bed rock 210 ft. below water and rises 295 ft. above it.

The second suspension bridge at San Francisco crosses the Golden Gate, the famous waterway leading from the bay to the Pacific Ocean. It has a main span of 4,200 ft., the longest in the world, which exceeds that of the George Washington Bridge, its nearest competitor, by 700 ft. The bridge has an overall length of 8,990 ft., and its towers attain the immense height of 746 ft. from the solid rock 100 ft. below water on which they rest. The pier on the San Francisco side was the first ever built in deep open water, and the bridge itself is the only one that has ever been built across the outer mouth of a great ocean harbour. One of the towers actually serves as a lighthouse, and undoubtedly the bridge is one of the greatest triumphs of constructional engineering.



The George Washington Suspension Bridge, which crosses the Hudson River at New York in a single span of 3,500 ft. Photograph by courtesy of the Port of New York Authority.

The last 21 years have seen equally remarkable developments in the building of other types of bridges, notably arch bridges. In 1917 the Hell Gate Bridge was the finest example of this type, but the erection of arches both longer and larger was soon being contemplated. One of these bridges was planned to cross the Kill van Kull, a waterway separating New Jersey from Statten Island, in lower New York harbour. It was completed in 1931 and its span of 1,652 ft. is the longest of its kind in the world. The Bayonne Bridge, as it is called, is not the largest arch bridge ever built, however. That distinction belongs to the Sydney Harbour Bridge, which was opened a year later. In span the Australian bridge is 2 ft. less than the American one, but it is much wider. The Bayonne Bridge carries only a roadway, comparatively narrow, while the Sydney Harbour Bridge has a total width of 160 ft., accommodating four electric railway tracks, a roadway wide enough for six lines of traffic, and two sidewalks, all at the same level. It is actually the widest long bridge of any kind in the world.

Although no huge structures such as these have been built in Great Britain since the completion of the Forth Bridge, several bridges of great interest have been erected, among them a splendid arch bridge across the Tyne at Newcastle. The span of this bridge is 531 ft., and is the largest in England.

Among cantilever structures the Forth and Quebec Bridges still remain supreme, although several bridges of this type have been built, chiefly in the United States. Up to 1916 the Queensborough Bridge across the East River at New York was the most

remarkable cantilever structure in the United States. Its two main spans of 1,182 ft. and 984 ft. respectively were much less than those of the Forth and Quebec Bridges, but the New York structure is remarkable for its capacity. It has two decks, the upper one carrying two railway tracks in addition to a roadway and a sidewalk, and the lower one having a roadway 51 ft. in width and two tramcar tracks.

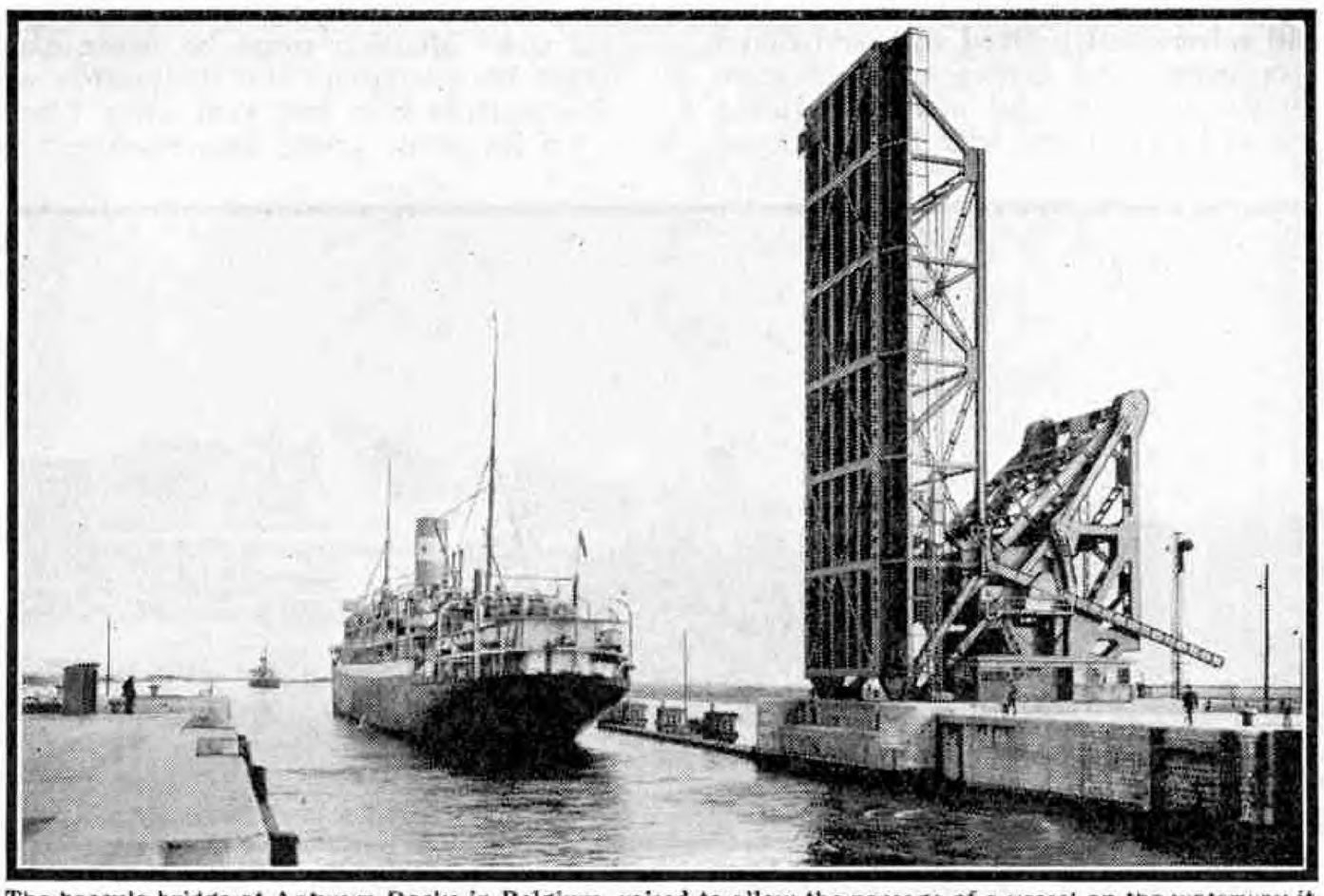
A cantilever bridge with a longer span than that at New York, and indeed one that is only exceeded by those of the Forth and Quebec Bridges, forms part of the great bridge crossing San Francisco Bay to which reference has already been made. It has a central span of 1,400 ft., and is double-decked. The upper deck carries a roadway for six lanes of traffic, and there are a narrower roadway and two railway tracks on the lower deck.



Two of the eleven vertical lift bridges that cross the Welland Canal, with their spans shown in the raised position.

Vertical lift bridges have received much attention in the last few years. They are specially suitable for bridging canals and other busy waterways, and their decks are simply raised to a convenient height when required to allow the passage of vessels beneath them. Many fine examples have been built in the last 21 years, including 11 bridges across the Welland Canal, in Canada. Two of the largest of these are shown in the upper illustration on this page, in which the decks are seen raised to allow the passage of a lake steamer along the Canal. They give a clearance of 110 ft.

While these bridges were being built, others that were larger were being constructed in the United States. One of these forms part of the 5,600-ft. structure across Suisun Bay, in California, which was built in 1929–30. The vertical lift span of this bridge has a length of 328 ft. and a lift of 65 ft., increasing the normal clearance of 70 ft. to 135 ft. when it is raised. Engineers had by no means reached their limit with its construction, and a vertical lift bridge with a much larger span now crosses the Delaware River, near Trenton. This has a lift span of 534 ft., which weighs 1,240 tons and is raised 74 ft. in two minutes. An even greater achievement of the same type is the Buzzards Bay Bridge, in the New England States. It has a lifting section of 544 ft., the largest in the world, and this is raised to an unusual height, leaving head room of 139 ft. over the waterway beneath it when it is in its upper position. This bridge was completed only in 1935.



The bascule bridge at Antwerp Docks in Belgium, raised to allow the passage of a vessel on the waterway it spans. The bridge is 130 ft. in length, and weighs 360 tons.

Fine examples of this type of bridge also have been constructed in Europe, although they do not rival the American vertical lift bridges in size. In Holland there is the Rotterdam vertical lift bridge, with a span of 174 ft., and in Great Britain a magnificent bridge of this kind has been constructed across the Tees at Middlesbrough. The lift span of this bridge is 270 ft. and weighs 2,700 tons, and it is one of the largest in Europe.

A vertical lift bridge is not suitable for all positions where opening spans are required, and engineers have devised various means of providing opening bridges for carrying roads and railways across waterways. One of the best known of these is the bascule bridge, of which the Tower Bridge across the Thames is the best known example. Yet another is the swing bridge, and what the engineer can do when called upon to plan and construct a bridge of this kind was shown when the Kincardine on Forth road bridge was completed last year. The total length of this bridge is 2,765 ft., or about half a mile, and its central section consists of a swing bridge 364 ft. in length and weighing 1,600 tons. This opens to leave a passage 150 ft. in width for navigation on each side, and so carefully has it been designed and constructed that its immense mass can be turned round with the greatest ease and brought to rest exactly in line with the fixed part of the bridge.

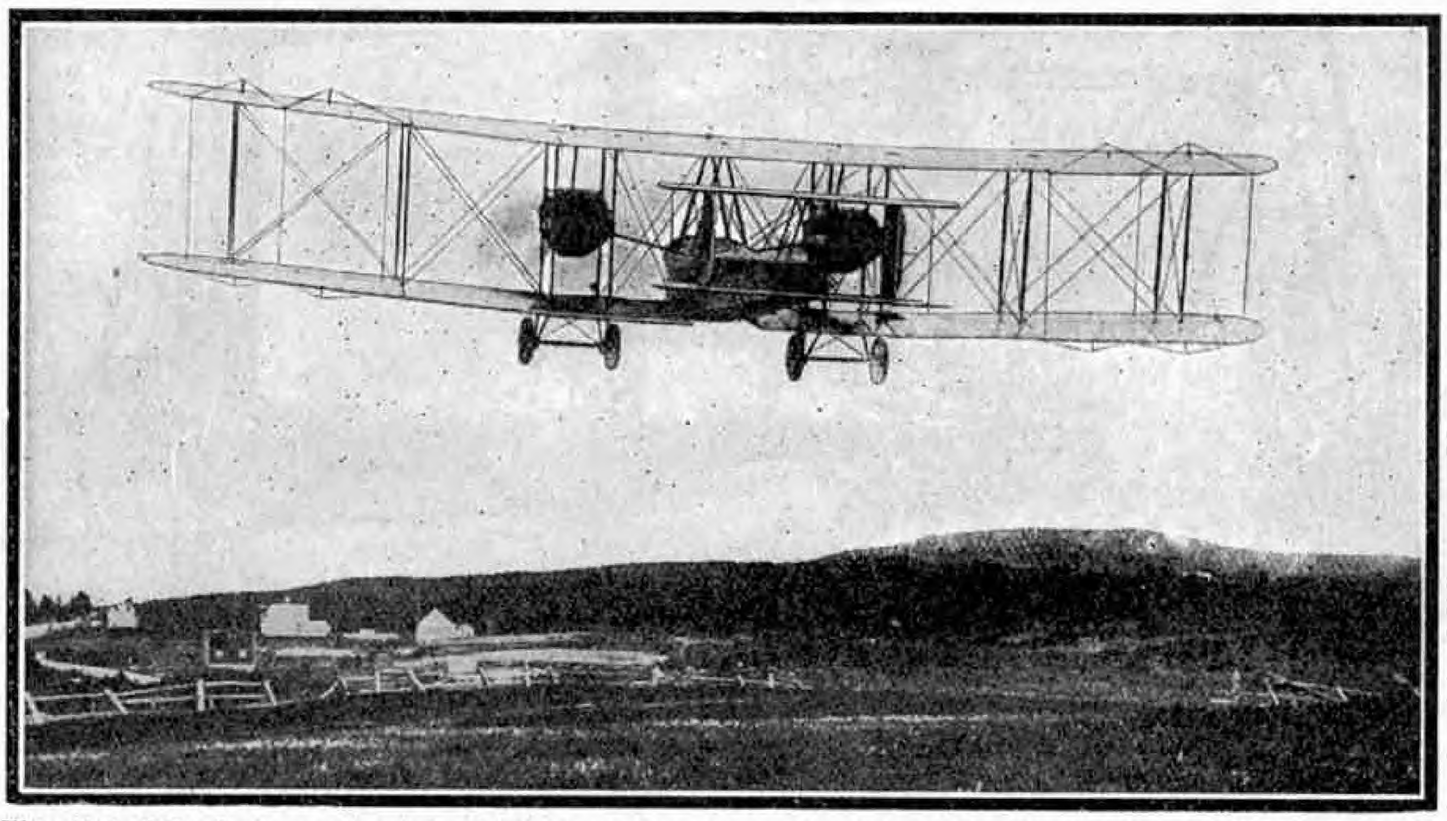
The modern bridge engineer builds largely in steel, and it is the use of this material, with its high tensile strength, that has enabled the masterpieces of the last 21 years to be built. He is always on the look out for new materials, however, and a recent development of great interest is the increasing use of reinforced concrete for bridge-building purposes.

In 1916 the outstanding example of a great bridge built of this material was the Tunkhannock Viaduct, in the United States, which had just been completed. The total length of this bridge is 2,375 ft., and consists of 10 spans of 180 ft. each, with two further spans of 100 ft. It towers 240 ft. above the river in the valley that it crosses. Since it was built other wonderful reinforced concrete structures have been erected. In the United States there is the George Westinghouse Memorial Bridge at East Pittsburgh. This was completed in 1931. It is not as long as the Tunkhannock Viaduct, but its 1,510 ft. includes a central span of 460 ft., which is the largest reinforced concrete arch in America. The distinction of having the longest reinforced concrete arch in the world belongs to Sweden, however. There the Traneberg Bridge has been built across the harbour at Stockholm, and this has a great concrete arch of 585 ft. The bridge was completed in 1934. It has an overall length of 1,902 ft. and the crest of the bridge rises 85.2 ft. above high water level over a width of 147 ft. The structure is 90 ft. in width and carries two electric railway tracks, a 39-ft. roadway, and two footpaths together with two bicycle paths.

Twenty-One Years of Civil Aviation

Stages Leading to a Transatlantic Service

THE year 1916 in which the *"M.M."* first appeared is almost the halfway mark between the beginnings of flying and the remarkable achievements of to-day, for it was in December 1903 that the Wright Brothers, in America, made the first flight in a heavier-than-air machine. The outbreak of the Great War in 1914 focussed attention on the military possibilities of the aeroplane, and by 1916 the British aircraft industry was entirely occupied in producing bombing and fighting machines. When the War ended, large quantities of military machines became surplus to requirements, and it was not until these had been absorbed for various civil purposes that a demand arose for machines specially designed for such purposes. The aircraft firms soon began to produce quite good machines, and the market for these gradually increased as the public became airminded.



The start of the first non-stop Atlantic flight, made on 14th-15th June 1919 by Capt. John Alcock and Lieut. A. Whitten Brown. Photograph by courtesy of Rolls-Royce Ltd.

The development of this airmindedness was speeded up by a series of splendid flights that showed that the aeroplane provided a reliable means of transport. The earliest of these flights was the first crossing of the North Atlantic by air on 14th-15th June 1919 by Capt. John Alcock and Lieut. A. Whitten Brown, both of the R.A.F. Their aeroplane was a Vickers "Vimy" twin-engined bomber that had been used during the War, and subsequently fitted with additional fuel tanks for the Atlantic crossing. The airmen took off from St. Johns, Newfoundland, in the evening, and after a thrilling night flight during which they had to contend with fog and snow showers, they landed at Clifden, in the Irish Free State, having covered the distance of about 1,890 miles in 15 hrs. 57 min., at an average speed of 118 m.p.h.

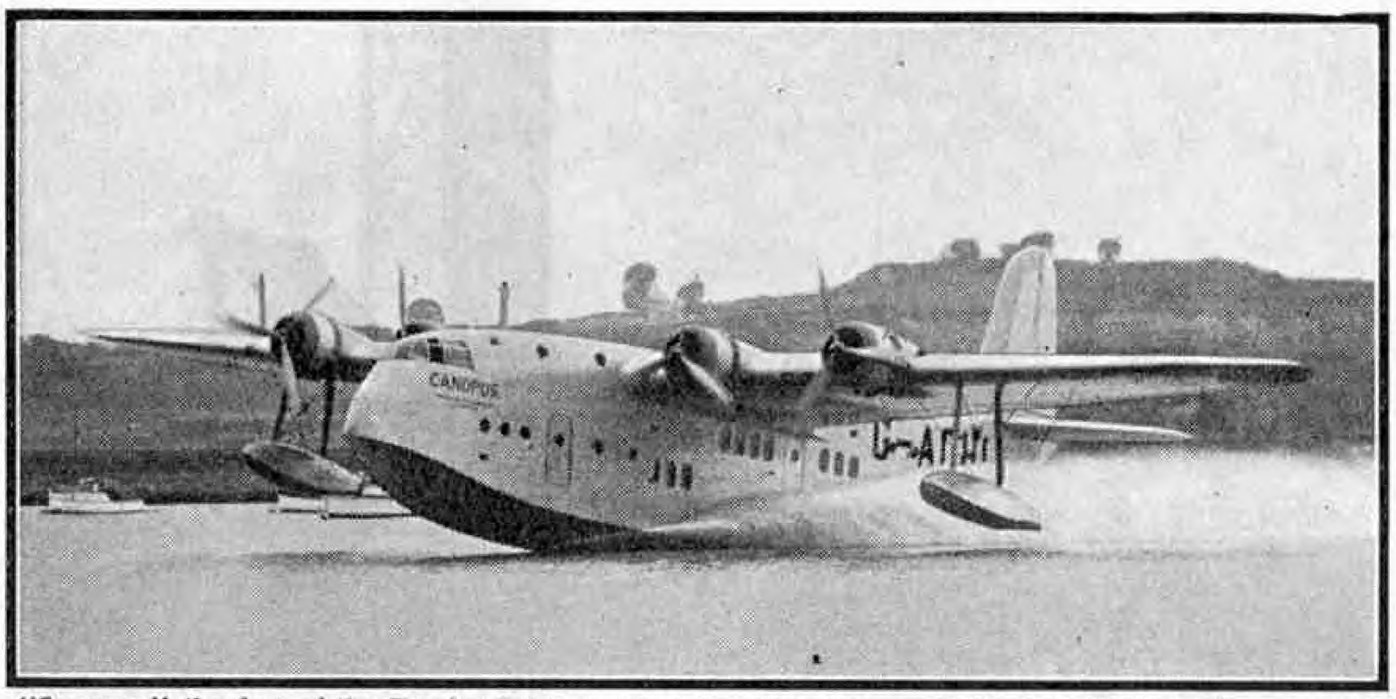
Another fine pioneer flight in a Vickers "Vimy" bomber was made in the same year by four Australians, Capt. Ross Smith, his brother Keith Smith, and two mechanics of the Australian Air Force. They took off from Hounslow Aerodrome, Middlesex, on 12th November, and flying by stages reached Port Darwin, on the north coast of Australia, on 19th December. They had covered the 11,130 miles in 27 days 20 minutes.

It was inevitable that sooner or later an attempt would be made to fly round the world, and in 1924 this was accomplished by United States Army Air Force pilots in 15 days 11 hrs. 7 min. flying time. The record was again lowered in 1931 by two Americans, Wiley Post and Harold Gatty, who, in a Lockheed "Vega" monoplane flew round the world in 8 days 16 hrs. 51 min. In 1933 Wiley Post, flying solo in the same aeroplane, improved on this time by making the round trip in 7 days 18 hrs. 49½ min., and this record is still unbeaten.

The long African survey flights of Mr., later Sir, Alan Cobham in 1924-25, and his great flight to Australia and back in 1926, attracted world-wide attention, and brought nearer the time when even the most distant parts of the Empire would be linked with the Mother Country by daily air services.

In 1927 public interest was again aroused by a revival of attempts to fly across the North Atlantic. The prospect of winning an American prize of £5,000 for the first non-stop flight from New York to Paris had much to do with these endeavours, and the prize was won by Capt. Charles A. Lindbergh, a young airman who was then the chief pilot of an American air line. Flying a Ryan high wing monoplane specially built for his attempt, Lindbergh took off from New York on 20th May, and landed at Le Bourget Airport, Paris, at 10.21 p.m. the next day, in the presence of a vast and excited crowd. He had covered the 3,610 miles non-stop in 33 hrs. 29 min., and was the first airman to accomplish a solo crossing of the North Atlantic.

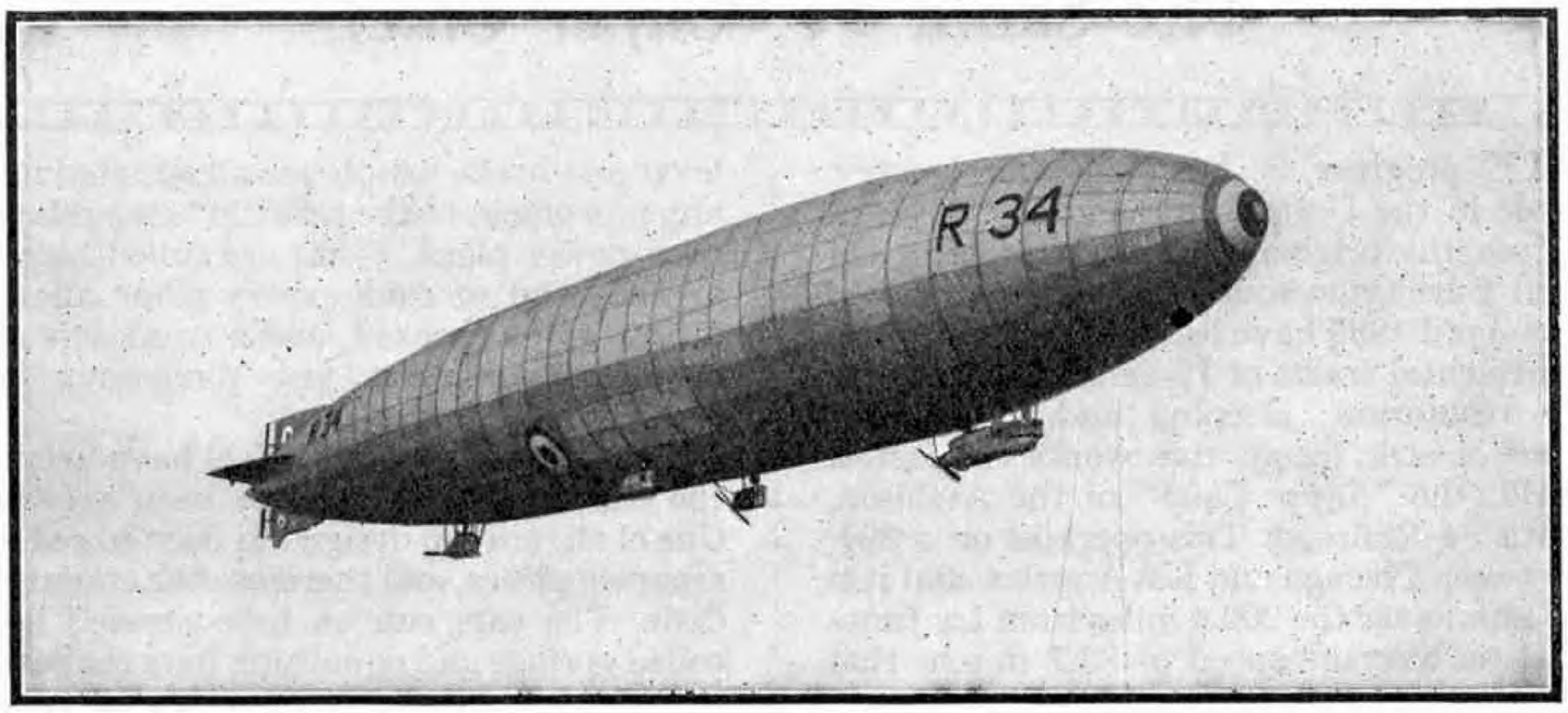
The first solo flight across the South Atlantic was made four years later by Bert Hinkler, who in his D.H. *"Moth"* flew from Port Natal, Brazil, to West Africa in the course of a 10,000-mile air tour. Mention must be made also of the first Atlantic solo flight by a woman. This distinction was achieved by Miss Amelia Earheart exactly one year after Lindbergh's flight. She took off from Harbour Grace, Newfoundland, in a Lockheed "Vega," and landed near Londonderry, Northern Ireland, the next day. Miss Earheart and her navigator, Capt. Noonan, were lost in June last in the Pacific, in the course of a flight round the world.



"Canopus," the first of the Empire flying boats of Imperial Airways, taking-off at Rochester, where the aircraft are being built. Photograph by courtesy of "Flight."

The development of high-speed seaplanes was greatly helped by the famous Schneider Trophy Contests, which began in 1912 but were suspended during the War. The speed of the winner of the first Schneider Trophy Contest was only 45¾ m.p.h., but that of the second Contest, held in 1913, was almost double this figure, and by 1926 the average speed of the winning machine had risen to 246.496 m.p.h. The 1927, 1928, and 1929 Contests were won by Great Britain, and the Supermarine racing seaplane that won the trophy permanently for this country in the 1929 race attained an average speed of 340.8 m.p.h. Shortly afterward this record was exceeded by Flight Lieut. G. A. Stainforth, who raised the record to 407 m.p.h. The present record for a seaplane was set up by Warrant Officer Agello, of Italy, on 23rd October 1934. Flying a Castoldi 72 seaplane at Lake Garda, he attained an average speed of 440.67 m.p.h.

Another famous series of racing contests was inaugurated in 1922 when the first King's Cup Race was flown. This annual British event, like the Schneider Race, has been characterised by a steady improvement in the performance of the winning machines. Great interest was aroused throughout the world by the MacRobertson Air Race in October 1934. The race was from Mildenhall, in Surrey, to Melbourne, Australia, over a route that totalled 11,300 miles, and was won by C. W. A. Scott and T. Campbell Black, in one of three D.H. "Comet" monoplanes specially built for the race. They reached Melbourne in 70 hr. 59 min., and were the first airmen to fly from England to Australia in three days. Mr. T. Campbell Black was killed on 19th September 1936 at the Speke Airport, Liverpool.



The British airship R.34 on a trial flight. In 1919 she flew across the Atlantic to America and back, and was the first airship to accomplish this feat. She was 643 ft. long, and had a top speed of 62 m.p.h.

The great majority of aircraft produced during the past 21 years have followed certain general lines, while differing in minor features. There have been exceptions, however, and probably the best known of these is the Cierva Autogiro, a wingless aeroplane invented by Senor de la Cierva, a Spanish aircraft designer, with the object of providing an aeroplane that could not stall or spin. The latest type of Autogiro has no wings, but instead has a large three-bladed rotor supported above the fuselage by a pylon-shaped structure; it can rise and descend vertically. De la Cierva was killed in 1936 in an aeroplane of the orthodox type. Another wingless aeroplane on somewhat similar lines to the Autogiro is the Hafner Gyroplane, which was demonstrated at Hanworth early this year.

The first regular air mail service between England and Europe was a military one operated by the R.A.F. from March to August 1919. The aeroplanes employed flew from Folkestone with mails for the Army of Occupation in Germany. The same year the first British commercial air service was introduced by a company called Air Transport and Travel Ltd. It linked London with Paris, and the single-engined 360 h.p. aeroplanes used carried a pilot, two passengers and a small freight load at a speed of about 80 m.p.h. Other promoters soon entered the field, and by 1924 there were three British companies operating regular services to the Continent and one running a flying boat service between Southampton and the Channel Islands. The latter service employed a single-engined 450 h.p. type of commercial flying boat with a top speed of about 80 m.p.h., and carried a pilot and six passengers.



The "direct-lifting" Autogiro, which can rise straight up into the air and can descend vertically. Photograph by courtesy of the Cierva Autogiro Co. Ltd.

An event of great importance to commercial aviation was the formation in 1924 of Imperial Airways Ltd., by the union of the four air transport firms just referred to. The company began by operating daily services to six European countries, and the total mileage of the routes covered was 1,760. Plans were drawn up for establishing regular air services to all parts of the Empire. The first commercial air link in this great scheme, between Cairo and Basra, was inaugurated in 1927, and two years later the India route was in operation from London to Karachi. In 1931 the first Central Africa sections of the Cairo-Capetown route were opened, and eventually a regular service over the 8,000 miles between London and Capetown was in operation. The India service was extended in stages to Calcutta, Rangoon and Singapore, and by the end of 1934 it was found possible to complete the air links through to Australia.

To-day the services operated by Imperial Airways and its subsidiary and associated companies extend over a distance of nearly 30,000 miles, and the aircraft of these companies fly more than 20,000 miles every day. When Imperial Airways began operations in 1924 their fleet totalled 13 machines, developing a total of about 5,000 h.p.; the company now have in operation or construction 76 aircraft, mostly multi-engined machines developing a total of 171,030 h.p.

Now that the Empire air routes are to be operated entirely by flying boats, a fleet of new four-engined aircraft of this type, larger and faster than any previously employed by the company, are being put into service. A detailed description of these fine machines was given in the December 1936 *"M.M."* A fleet of new multi-engined landplanes is also under construction, and the first of these "Ensign" class monoplanes was described in the *"M.M."* of March 1937.

Serious attention is being given to the establishing of a regular air service across the Atlantic to Canada and the United States, to be operated by Imperial Airways in co-operation with Pan-American Airways. During this year a series of experimental Atlantic flights has been carried out by the *"Caledonia"* and *"Cambria,"* two of the Empire flying boats specially equipped for the work, and the Pan-American Airways flying boat *"Clipper III."*

The story of airship development during the past 21 years is a less happy one, as although some notable flights have been achieved, most of the large airships have been wrecked. After the disaster to the R.101, which was wrecked in France while on an experimental flight to India in October 1930, the British Government abandoned airship construction. In the United States a series of disasters resulted in a similar decision being taken in 1935. Germany has fared better, and the *"Graf Zeppelin"* built in 1928 was in service on the Atlantic airship route until her retirement early this year, and flew with the regularity of an express train. In 1935 the *"Graf Zeppelin"* was joined in the Atlantic service by the *"Hindenburg,"* a larger airship driven by four Diesel engines and having a top speed of 84 m.p.h. When the *"Hindenburg"* arrived at Lakehurst, U.S.A., on her first trip of the 1937 season, an explosion occurred near the airship's stern as she was about to land, and she burst into flames and crashed to earth, 34 of the 94 people on board being killed. The tragic loss of the *"Hindenburg"* has not shaken German faith in the future of airships, and the Atlantic service is to be re-opened next year with two new Zeppelins.

The Fastest Train in the World

The Santa Fé *"Super Chief"*

REMARKABLE progress in Diesel-electric traction has been made in the United States in recent years. Developments from the original three-car trains of the Union Pacific and Burlington routes that were described in the "*M.M.*" in April 1935 have led to the introduction of great transcontinental trains of 17 vehicles, having on board complete restaurant, sleeping and observation facilities. A Diesel-electric locomotive works the fastest train in the world, the "*Super Chief*" of the Atchison, Topeka and Santa Fé Railroad. This operates on a 39¾-hour schedule between Chicago and Los Angeles, and it is its timing of 145 min., over the 202.4 miles from La Junta to Dodge City at an average speed of 83.7 m.p.h. that makes it the world's fastest train. The "*Super Chief*" makes one run in each direction each week.

Since May of this year completely new equipment has been in use on this service, and the striking appearance of the new train is well shown in the accompanying illustration. Its regular make-up consists of nine vehicles, headed by a twin-unit 3,600 h.p. streamlined Diesel-electric locomotive. Unlike those of many other American Diesel-electric trains the cars are not articulated, but each runs on its own separate bogies. There are two postal cars, one for mail sorting and for mail storage and the other for mails and passengers' baggage. Two sleeping cars follow, named respectively "*Isleta*" and "*Laguna*"; then comes a lounge car, the "*Acoma,*" which includes a hairdressing saloon, or "barber shop" as the Americans prefer to call it. Next is the dining car "*Cochiti,*" with two further sleeping cars, named "*Oraibi*" and "*Taos*" respectively, and at the tail of the train is the "*Navajo,*" a special saloon with a rounded rear end for observation purposes.



The "Super Chief," the fastest train in the world, hauled by a streamlined Diesel-electric locomotive of 3,600 h.p. Photograph by courtesy of the Atchison, Topeka and Santa Fé Railroad.

Each of the two units of the locomotive is of 1,800 h.p., developed by two 900-h.p. Diesel-electric power plants. Both plants are controlled simultaneously from the main locomotive throttle. Six-wheeled bogies support the two units of the locomotive, and the main frames are of trussed construction with cross-members supporting the machinery. Welding has been largely used in building up the structure, although riveting also has been employed.

The second unit of the locomotive can be operated independently when required, as for yard and turntable movements, but the main locomotive throttle, reverse lever and brake handle are all situated in the driving cab, any movement of the throttle being relayed electrically to each power plant. What are called local control stations at the head of each power plant allow operating conditions to be checked, and a trunk line alarm system immediately indicates any dangerous engine condition or failure.

Two types of stainless steel have been used in building the train, and welding has been extensively employed. One of the aims in design has been to reduce the number of separate pieces, and therefore the amount of welding to be done. The cars run on four-wheeled bogies having the coiled springs and equalising bars that are usual in U.S.A. practice. Some of the cars have roller-bearing axle-boxes.

The exterior of the train is completely sheathed in stainless steel. Narrow curved panels, beaded longitudinally, are used below the windows and these give a characteristic "ribbed" appearance to the sides. Between the windows the panels are flat, but corrugated sheets are employed above the windows and on the roofs of the cars. The surface is left bright, there being no painting on the cars except for their nameplates below the windows, and the name, "*Santa Fé,*" above them.

In the decoration of the cars special care has been taken to suggest the country and the native traditions of the South West, through which the train runs. The colours employed follow those of the landscape, and those found in the craft work of the Navajo Indians. In all the passenger sections air-conditioning equipment furnishes a supply of air that is partly composed of a controllable amount of fresh air from the outside of the car and partly of air re-circulated from the inside. Filters ensure the cleanliness of both fresh and return air before it is passed over heating or cooling coils as required.

Special attention has been devoted to comfort in the sleeping cars and an innovation is found in the arrangement of the upper berths. Normally in American trains these are arranged to swing upward out of use during the daytime, thus forming a curved "side ceiling." In the "*Super Chief*" cars, however, the berths are flat, and the upper one is made to push straight up out of the way, so that during the daytime it forms a flat ceiling directly over the "section" or compartment.

London Coal Traffic on the L.M.S.

Powerful "Garratts" for Trains of 1,400 Tons

THE transport of coal formed the original reason for the development of railways and is yet a very important part of the business of the railway companies. In the course of a year the tonnage of coal, coke and patent fuel conveyed by the four groups amounts to 170,937,000 tons, and of this the share of the L.M.S. is 74,000,000 tons. More coal for domestic purposes is conveyed to London and its surrounding districts than to any other place in the country, and the L.M.S. carry 2,500,000 tons there every twelve months.

There is a rush of coal traffic for domestic purposes in autumn, when the weather turns colder, and the pressure of holiday traffic has no sooner ended than the long coal trains begin to pass with greater frequency. It is very fascinating to stand at some line-side point on one of the great coal-carrying routes and to watch the procession of coal trains passing up to London. Much of this "black diamond" traffic is carried in private owners' wagons, most of them boldly lettered with the names of the coal merchants or colliery companies owning them and many displaying bright and sometimes even startling colour schemes.



A coal train on the Midland route of the L.M.S. before the introduction of the "Beyer-Garratt" articulated locomotives, with two 0-6-0 engines at its head. The illustrations on this page are reproduced by courtesy of the L.M.S.

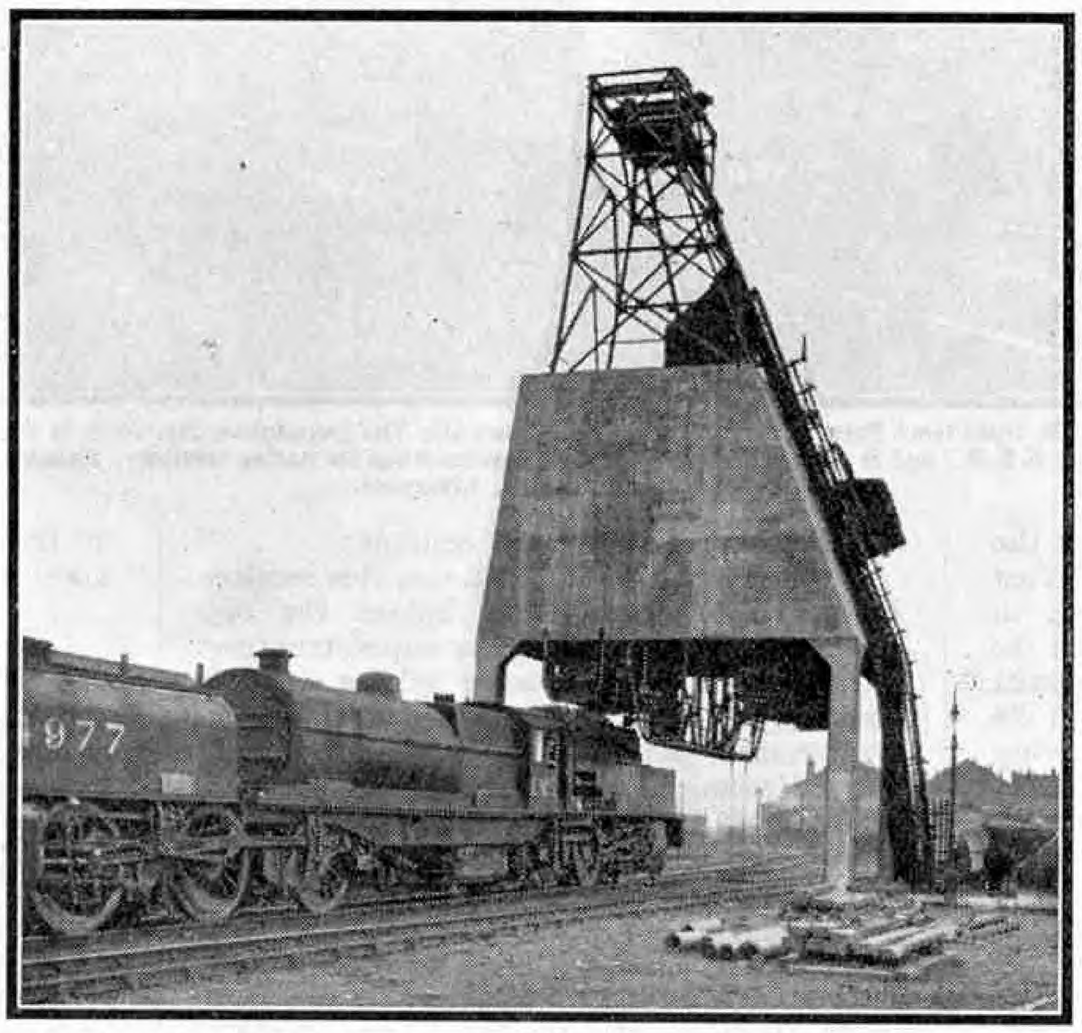
London coal traffic on the L.M.S. is conveyed by both Western and Midland routes, and is dealt with at Willesden and Cricklewood respectively. At these well-known centres the trains are "broken up," and the wagons are then distributed in other trains to the suburbs, docks, local coal depots and other destinations.

The Western Division coal trains bound for Willesden, and the corresponding returning empty wagon trains, are hauled by eight-coupled locomotives. There are the 0–8–0s of the former L.N.W.R., long used on this work, their L.M.S. developments of the "9500" series, and the newer standard 2–8–0 engines with tapered boiler barrels introduced by Mr. Stanier. All these engines can hold their own with heavy trains on this gently-graded main line.

On the Midland Division the gradients are sharply undulating. This fact and the bulk of the traffic passing has led to the use of articulated locomotives of the "Beyer-Garratt" type, the only ones used on main line work in this country. These have the 2–6–0 : 0–6–2 wheel arrangement, and are the most powerful locomotives on the L.M.S. They regularly haul trains of 90 loaded wagons, or an average gross tonnage of 1,400, in the up direction between Toton Sidings, near Nottingham, where the traffic is concentrated, and Cricklewood. The load in the down direction is 100 empty wagons.

Three engines of this class were introduced experimentally in 1927, and were so successful that a further 30 were added three years later. Prior to the introduction of these engines it had been necessary to use 0–6–0 engines working in pairs, an uneconomical method of operation involving two sets of men as compared with the working of one large locomotive in charge of a single crew. With the introduction of the Garratts it has been possible to accelerate the trains concerned, and the journey in the up direction is usually run at an average speed of 19 m.p.h., while the empty wagon trains on the down run make an average of 24 m.p.h. or so.

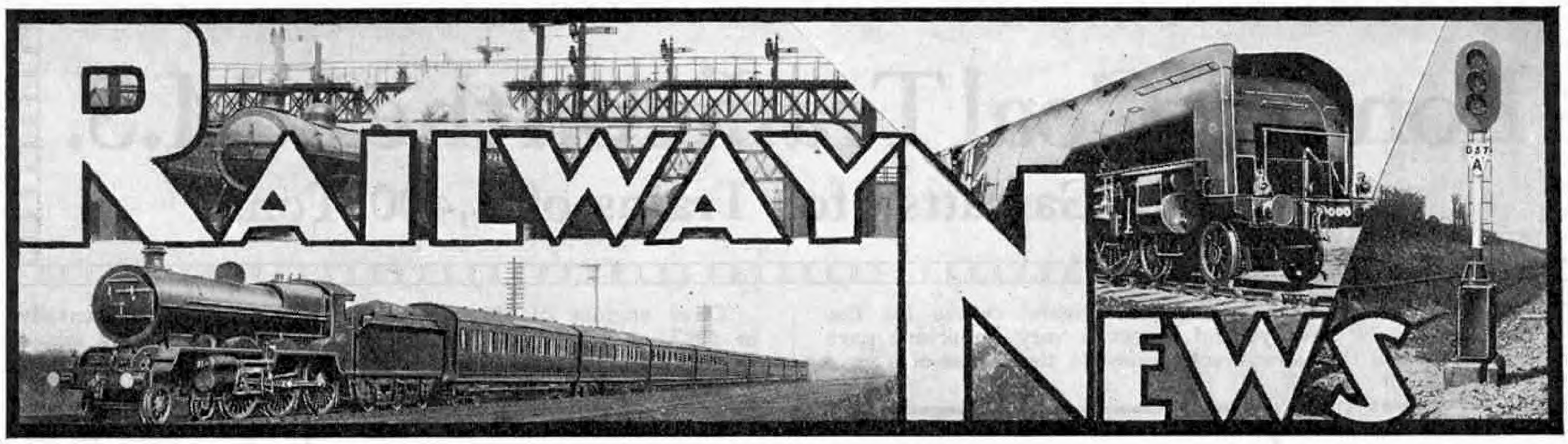
The capacity of the "Garratts" is an important aid in securing punctuality, for coal trains must operate to schedule to avoid alternate spells of congestion and shortage in distribution. It is essential also that the work at the coal distributing centres should be performed with the maximum speed. At Willesden and Cricklewood the number of trains dealt with each week is 124 and 106 respectively, but these figures do not represent the total capacity of the yards. On the arrival of a loaded train at the marshalling and receiving points, the usual procedure is for a leading shunter to look quickly over the train, noting the destinations of the wagons. On the leading end of each wagon, or "cut" of wagons, he puts a chalk mark. This mark indicates the sorting siding to which it must be shunted, according to its destination, for different destinations or routes have their appropriate roads.



One of the 2-6-0 : 0-6-2 "Beyer-Garratt" locomotives of the L.M.S. now used on coal trains between Toton Sidings and Cricklewood. They regularly haul trains of 90 loaded wagons or 100 empties over the difficult Midland route.

The wagons are then shunted into the required sidings, the disposal being carried out so rapidly that as many as 15 wagons may be on the move in their appropriate sidings at the same time. Shunters or "steadiers," as they are termed, are on the alert to brake the vehicles, and to position them against wagons that may have been previously shunted and are standing in the sidings. So quickly do these gangs work that it is not unusual for a 70-wagon train requiring 60 separate "cuts" to be shunted in eight minutes at a large marshalling yard in the Midlands.

Somewhat similar methods are followed when the empty wagons are being returned to the collieries. In the movement of wagons generally the chief aim is to keep them running as much as possible. Otherwise a temporary shortage of wagons at the collieries is the result. This would cause delay and congestion of traffic, which would be followed by a shortage of coal at the distribution depots.



Fast Running by a G.W.R. "Hall"

Modern mixed-traffic locomotives such as the G.W.R. "Halls" are capable of remarkably high speed when occasion demands, driving wheels of 6 ft. or less in diameter being no handicap to the attainment of speeds in excess of 80 m.p.h. Most of such spurts are made downhill, but a recent run up from Reading on the Weymouth express due in Paddington at 3.30 p.m. provided a notable example of what the "Halls" can do on the dead level. The load was only moderate, 219 tons tare and 235 tons with passengers and luggage, or just about the usual weight of the *"Cheltenham Flyer,"* and No. 5949 *"Trematon Hall"* set about the job in true *"Cheltenham Flyer"* style. At Twyford, five miles from the start, speed was up to 66 m.p.h., and the rate then rose to a steady and unvarying 75 m.p.h. from Burnham Beeches onward. Maidenhead, 11.8 miles, was passed in 13 min.; Slough, 17.5 miles, in 17¾ min., and Mile Post 11½, 24½ miles from Reading, was cleared in 23½ min. The speed had now fallen off slightly, to 71 m.p.h., when there came a severe signal check to 20 m.p.h. approaching Hayes.

Nothing daunted, the driver got his engine away again in tremendous style, accelerating from 20 to 53 m.p.h. in 1¾ miles. Ealing Broadway was passed at 62½ m.p.h., and in spite of the check the train cleared Old Oak Common West Junction, 32.7 miles from Reading, in 33¾ min. The speed had now risen to 67 m.p.h., and a smart finish brought the train into Paddington on time in 38 min. from Reading, the start having been 2 min. late. Allowing for the effects of the bad check at Hayes the net time for the 36-mile run was only 35 min., a very smart performance.

On this journey the engine was worked almost throughout on the jockey-valve, or "first regulator." The cut-off during all the high-speed running was fixed at 35 per cent. The "Hall" class engines are of course fitted with Stephenson's link motion, which cannot be notched up to the 15 or 20 per cent. cut-offs that are common with Walschaerts gear. The valve gear of the "Halls" differs from modern practice also in that the gear is actuated by a notched lever instead of a wheel and screw.

This run was recorded by Mr. O. S. Nock.

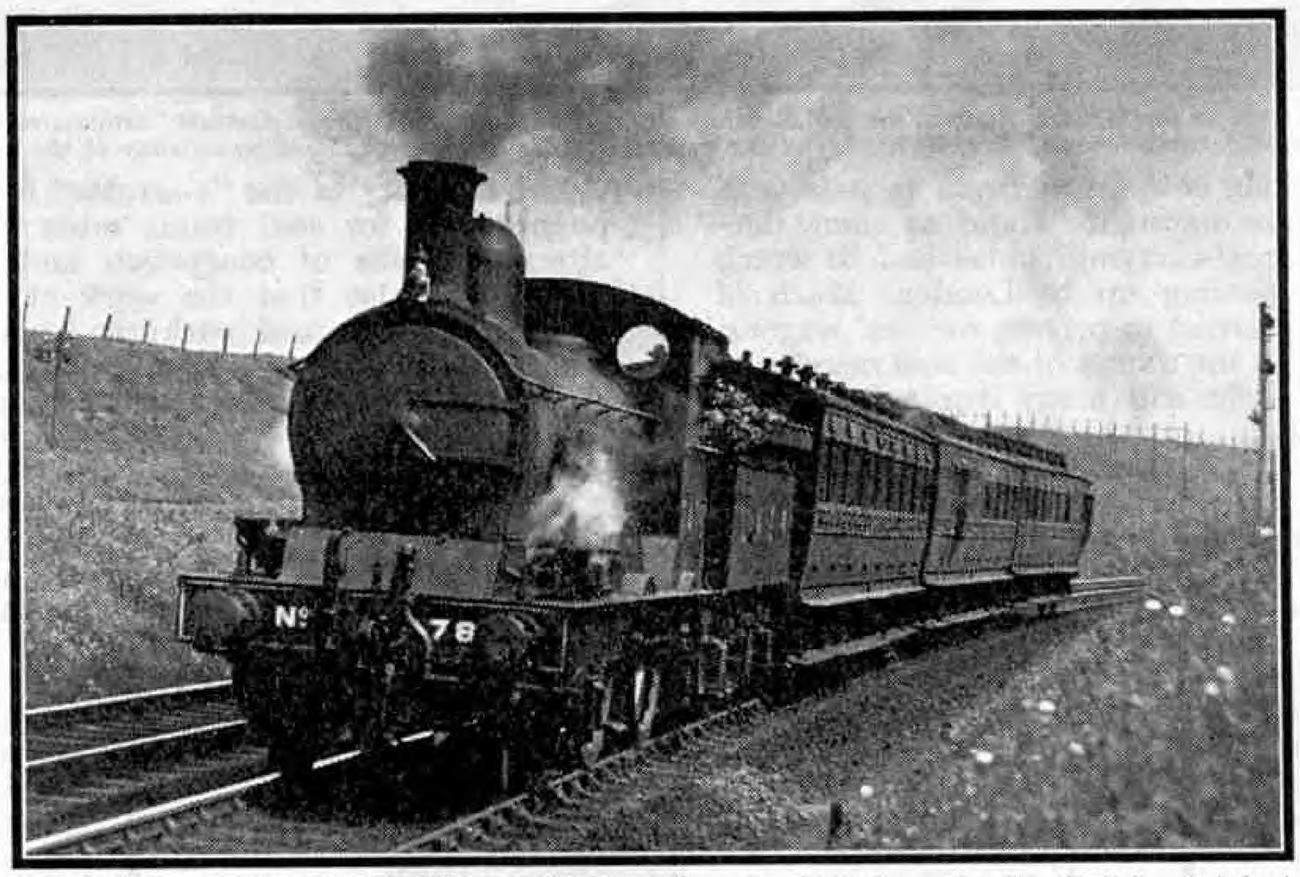
Stronger Bridges—Bigger Engines

Two large bridges on the St. Pancras to Manchester main line of the L.M.S. are to be reconstructed in order that bigger engines may be employed for both freight and passenger trains. The first bridge to be replaced is situated immediately south of Chapel-en-le-Frith station. It was built in 1865 and strengthened in 1891, and consists of three wrought-iron arched girders, cross girders and floor plates. The new structure will be composed of three main steel girders, with steel cross girders, carrying a floor laid with concrete.

Owing to the heavy traffic on this section it has been decided to replace the old bridge by building the new superstructure on staging, and then, after taking out the old superstructure, to roll the new bridge bodily into position. This will leave only the ballasting and permanent way work to be done, and will require no more than 16 hours' work before normal traffic conditions are restored.

It is expected that the whole of the work will be completed in or about next February. Similar operations will then begin immediately on the second bridge, which is situated between the North and South Junctions, Chinley. The work here is to be finished by next May.

When reconstruction of these bridges is completed, locomotives whose weight does not exceed that of the "Royal Scot" express engines will be permitted over the route. The strengthening of several other important bridges on the Derby-Manchester line has been carried out in recent years.



An L.N.E.R. train from Penrith to Darlington near Yanwath. The locomotive, No. 7478, is a 2-4-0 of the former G.E.R., and is thus working a long way away from its native territory. Photograph by the Rev. E. Treacy, Liverpool.

Notable Run by an L.M.S. "Princess"

Driver Tom Clarke, the L.M.S. speed "ace" whose feats on the footplate of *"Princess Elizabeth"* and *"Coronation"* are already familiar to *"M.M."* readers, accomplished a remarkable run in ordinary service recently when he drove a 16-coach train, weighing 504 tons tare and 535 tons gross, from Crewe to London in 152 min. 40 sec. for the 158.1 miles. This run was the more remarkable because the engine, Stanier 4–6–2 No. 6212 *"Duchess of Kent,"* was on the last lap of a 400-mile journey from Glasgow (Central). The journey was performed with a very careful observance of all the speed restrictions and without the maximum speed anywhere exceeding 76 m.p.h.

Leaving Crewe, *"Duchess of Kent"* sustained the remarkable speed of 52 m.p.h., with this very heavy load, all the way up the three miles at 1 in 177 of the Madeley "bank." Another noteworthy effort was from Bletchley to Tring, 15 miles mostly uphill in 13 min. 9 sec., with a minimum speed of 63 m.p.h. By this grand effort Driver Clarke converted a late departure of five minutes from Crewe into an arrival at Euston 3 minutes early. This run was recorded by Mr. D. S. Barrie, who was one of the official recorders on the occasion of *"Coronation's"* record run that was described in the *"M.M."* in August last, when a maximum speed of 114 m.p.h. was attained.

From "Castles" to "Earls"

A series of G.W.R. locomotives of the "Castle" class, Nos. 5043-5062, has been renamed as follows: *"Earl of Mount Edgcumbe," "Earl of Dunraven," "Earl of Dudley," "Earl Cawdor," "Earl of Dartmouth," "Earl of Devon," "Earl of Plymouth," "Earl of St. Germans," "Earl Bathurst," "Earl of Radnor," "Earl Cairns," "Earl of Ducie," "Earl of Eldon," "Earl of Powis," "Earl Waldegrave," "Earl of Clancarty," "Earl St. Aldwyn," "Earl of Berkeley," "Earl of Birkenhead," "Earl of Shaftesbury."* The names of the first 12 of these have been taken from the reconditioned small-wheeled 4–4–0 engines hitherto known as the "Earl" class.

No. 5063, another "Castle," has been named *"Earl Baldwin."* Two further engines of the "Castle" class, Nos. 5064 and 5065, have been named *"Bishop's Castle"* and *"Newport Castle"* respectively.

"Passenger Comfort" for Goods

The L.M.S. recently at their St. Pancras Goods Depot demonstrated a new experimental shock-absorbing 12-ton goods wagon that is claimed to be the first of its kind in the world. This is the outcome of an idea originally formulated by Mr. E. J. H. Lemon, Vice-President of the L.M.S., to provide "passenger comfort" and protection for freight consignments, by insulating them from shocks due to impact, or to the snatching of couplings, during conveyance or in shunting operations.

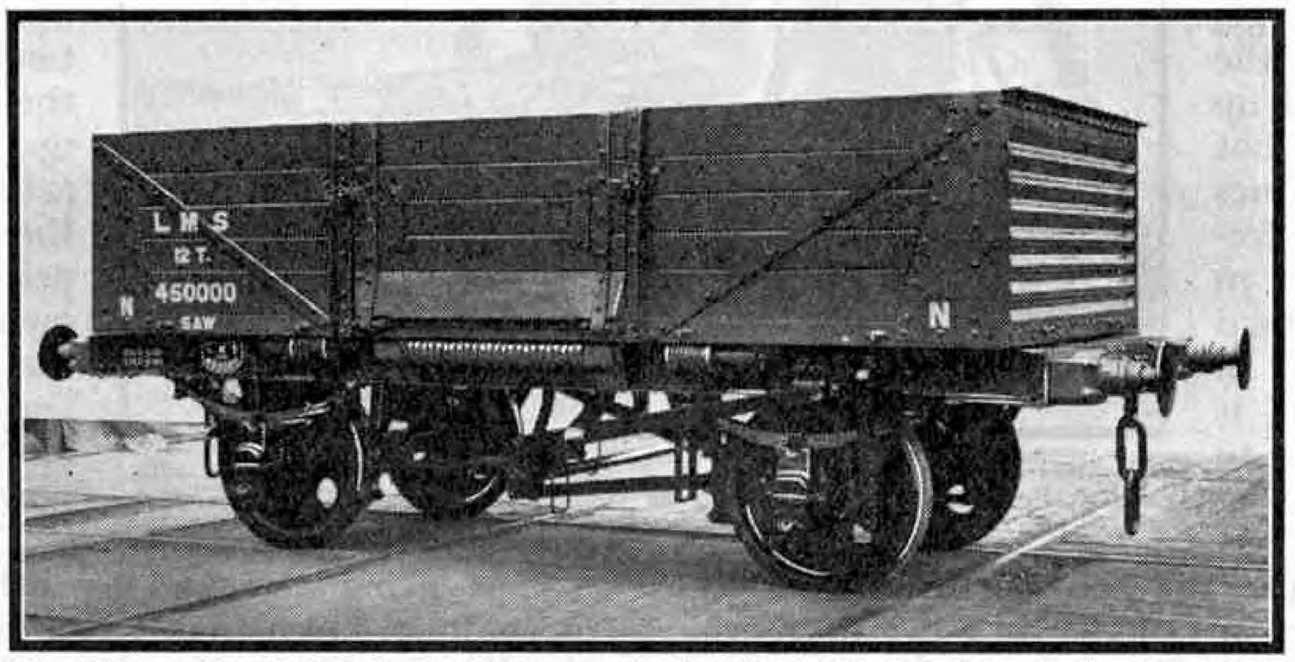
The new type of wagon has been designed by the Chief Mechanical Engineer of the L.M.S., Mr. W. A. Stanier, and 100 of these vehicles are being constructed at Derby. The body of the wagon "floats" on the chassis by means of a springing arrangement, while additional protection is given by special shock-absorbing buffers.

The shock-absorbing element consists of two sets of horizontal, india-rubber springs forming a buffing arrangement between the wagon body and the chassis on which it rides, and of four sets of horizontal rubber springs which are attached to the chassis and act in the same way.

The effects of any longitudinal shock delivered to the wagon are largely absorbed in compressing these springs, and to that extent do not reach the body and the goods inside it. Immediately after the shock the springs quietly re-open, causing the body to follow the shock movement of the chassis until it regains its normal central position in readiness for any subsequent shock.

The body is supported and connected to the chassis by four slides which allow of longitudinal movement but prevent lateral or vertical movement of the body relative to the chassis.

Tests conducted with sheet glass in crates, earthenware and china in crates, and similar classes of traffic, have demonstrated the superiority of the special vehicle in eliminating or minimising the risk of damage to goods in transit.



One of the new L.M.S. "shock absorbing wagons" referred to on this page. The sets of rubber springs that absorb the relative movement between the body and the underframe can be seen on the sole-bar. Photograph by courtesy of the L.M.S.

G.W.R. Record Winter Train Mileage

In the G.W.R. winter services 90 trains included in this Summer's services are retained for the winter. The daily mileage run by G.W.R. trains is 115,588, the highest winter figure recorded in the history of the Company.

The eighteen streamlined railcars in use throughout the system will cover 3,592 miles daily. The highest booked G.W.R. railcar speed is made by the 11.6 a.m. car between Castle Cary and Westbury, a distance of 19¾ miles that is run in 18 min., at an average speed of 65.8 m.p.h. This is the fourth highest start-to-stop run on the system.

New L.N.E.R. High Speed Train Services

The L.N.E.R. have inaugurated a new era in travel between the West Riding of Yorkshire and London by the introduction of the new streamlined *"West Riding Limited"* express in each direction between Bradford, Leeds and London. In addition the existing fast service from Harrogate by the *"Yorkshire Pullman"* has been accelerated and extended to provide, for the first time in railway history, a Pullman car service between York and London.

The *"West Riding Limited"* streamlined trains perform the journey in each direction between Leeds and London in 2¾ hours non-stop, as compared with the previous quickest time of 3 hours 10 minutes; the revised working of *"Yorkshire Pullman"* reduces the journey time from Harrogate to London by a quarter of an hour. The *"West Riding Limited"* is formed of streamlined coaches unlike any previously seen in service in the West Riding. The train commences and terminates its journeys at Bradford, the Halifax service being given by good connecting trains. The throughout speed of the train over its 186-mile non-stop run between Leeds and London is 68 m.p.h. in the "up" direction and 68.5 on the return journey to Leeds. The train is limited in capacity and a small supplement is charged as is done on other high-speed trains on the L.N.E.R. The locomotives used are of the well-known L.N.E.R. streamlined "Pacific" type, similar to those hauling the "Coronation" express, the fastest train in the British Empire.

An important work in connection with the new service is the reconstruction of the bridge carrying the L.N.E.R. main line over the River Calder, immediately south of Wakefield. This structure, officially known as "Bridge No. 60," has been scheduled for reconstruction for some time, but this has been delayed by the present state of the steel industry. During the period of reconstruction it is necessary to place a speed restriction on the *"West Riding Limited"* and other trains passing over the bridge.

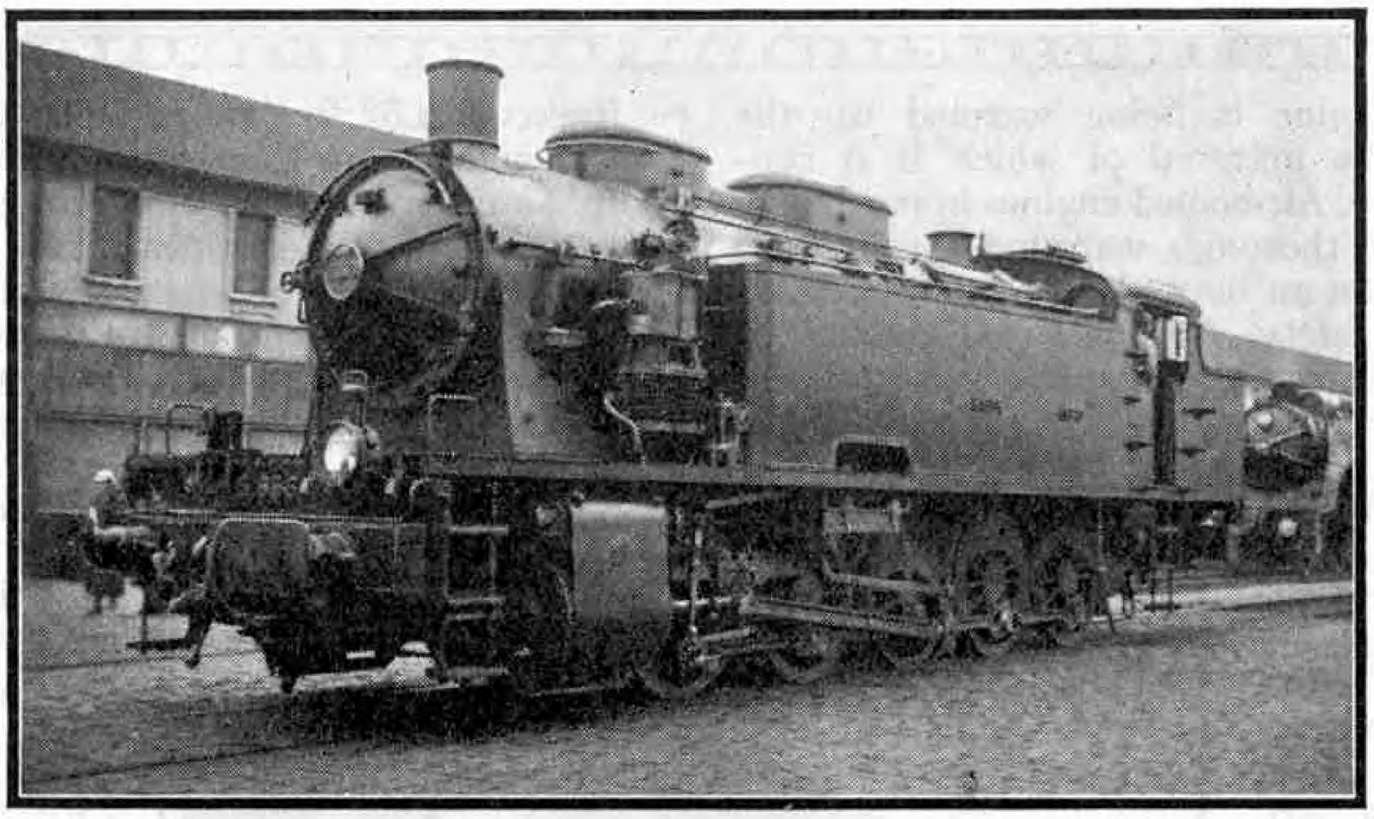
"Bridge No. 60" is famous in the Wakefield district for its graceful cast-iron span, 170 feet in length. This is one of the longest in the country for a bridge spanning the higher reaches of a small river like the Calder and since February 1st, 1866, it has been in continuous use. It is situated at the South end of the strong brick viaduct known locally as "the 99 arches" which carries the L.N.E.R. main line into Wakefield. L.N.E.R. engineers, although having to give first consideration to strength, have found it possible to do so without sacrificing the graceful lines of the older structure, and the new steel bridge when finally in position will present the same beautiful lines to the observer as were found in the old structure.

Three additional fast trains now run in each direction between London and Cambridge on Mondays to Fridays inclusive. All perform the journey non-stop in 65 minutes. There are now ten buffet car train services in operation each way daily between London and Cambridge, of which five start from and terminate at King's Cross and the others run to and from Liverpool Street. This improved service has developed from the five buffet car trains in each direction per day between Cambridge and King's Cross inaugurated in 1932, when the trains each consisted of three coaches. So popular has the service become that at least double this accommodation now has to be provided.

A new express, named the *"East Anglian,"* now runs between London, Norwich and Ipswich and is hauled by "Sandringham" class locomotives that have been specially streamlined.

New Turntables for G.C. Section

The L.N.E.R. are to install 70 ft. turntables with the vacuum tractor arrangement at Marylebone and Leicester, so that the "Pacific" and 2–6–2 "Green Arrow" types can be run on the Great Central section. It has become necessary to provide for larger engines in order to deal with the increasing loads of the fast trains now running to and from Marylebone.



Many characteristics of French locomotive practice can be observed on this Nord 0-10-0 tank locomotive, No. 5-656, at Boulogne Harbour. This H.R.C. prize-winning photograph is by B. R. Hamilton (H.R.C. No. 1731), London, N.W.2.

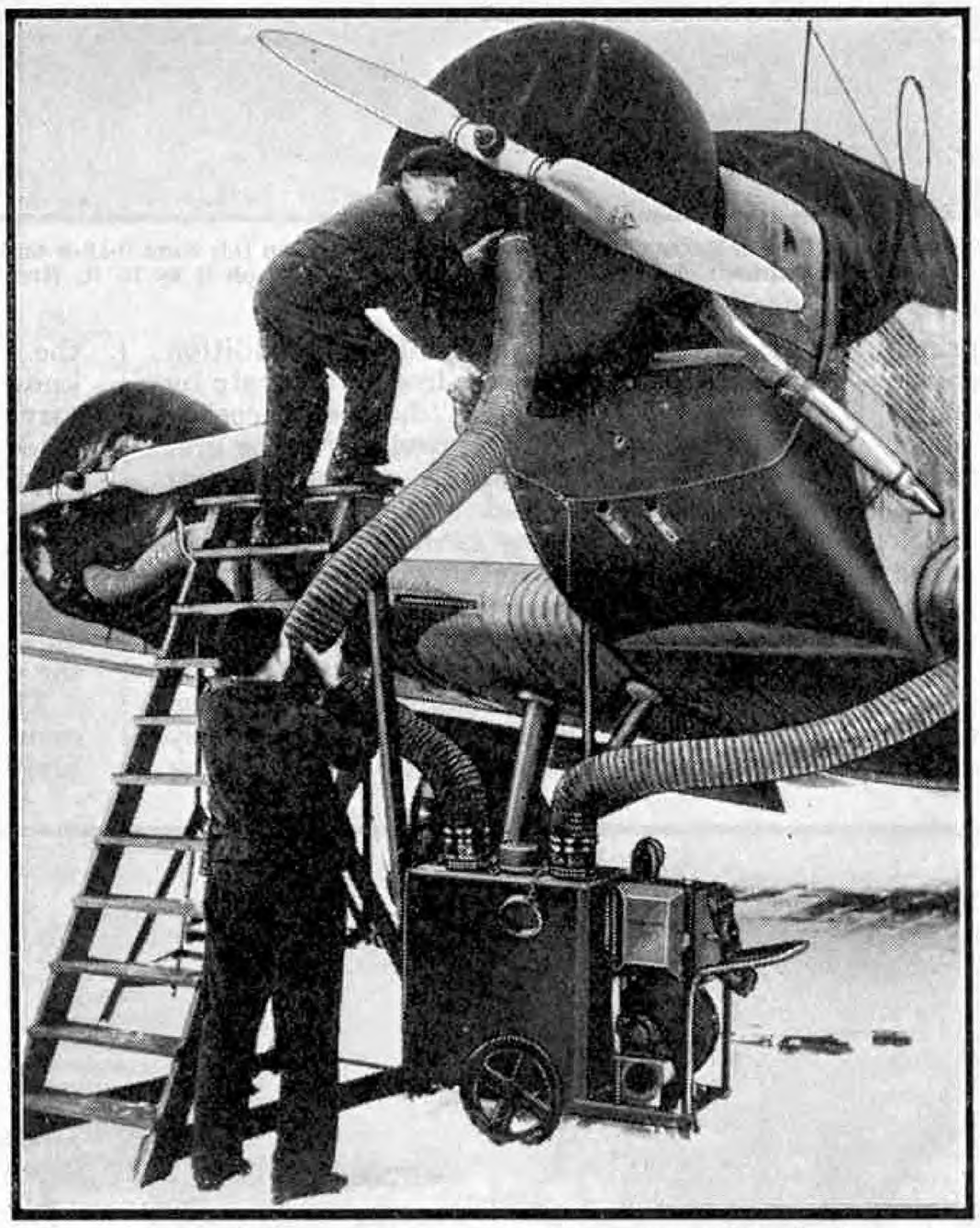
Starting Aero Engines in Cold Weather

Electric Heater Shortens Warming-Up Process

WHEN an aero engine is being warmed up the temperature of the material of which it is constructed rises very slowly. Air-cooled engines in particular require a long time for thorough warming throughout, and sometimes more than an hour elapses before a take-off can be made with safety. A substantial amount of fuel is consumed in the warming-up process, and the loss of time in winter leads to a reduction in the availability of aircraft for service. This is a serious matter for air companies, with whom timetable working is essential.

The ground staffs of all aircraft operators are on the look out for any means of overcoming the effects of winter conditions without reducing safety. The most obvious idea is to use artificial heating to keep out the cold and to create summer conditions. The means of producing the necessary heat, and of conveying it to where it is wanted, must depend to some extent on the degree of cold encountered, and the size and design of the engine to be heated. The more intense the cold or the greater the engine, the more difficult will be the heating process.

If the cold is not severe and the engine not too large, it is sufficient to heat the lubricating oil, and to fill up the cooling system with hot fluid if liquid-cooled engines are concerned. The oil is frequently heated by means of a specially-designed electrical immersion heater inserted in the tank, and the engine is turned by hand in order to make sure that the heated oil reaches every part.



Warming up the three engines of a Junkers Ju. 52/3m air liner with electrically-heated air. Photograph by courtesy of Junkers Flugzeug- und -Motorenwerke A. G., Dessau.

A comparatively simple method of heating aero engines is in common use in Canada and the northern districts of the United States. There the engine, or even the whole engine bay, is completely enclosed in a cloth cover, and the air within this is warmed by means of a blow lamp. The cover is made of ordinary tent material and extends down to the ground. It is made of closely-woven fabric impervious to air, and as it generally forms part of the equipment carried on board the aeroplane it is usually unlined in order to save weight and space. If the weather is very cold several lamps are used and they are placed on the ground under the engine, with the flames directed upward. A period of from 2½ to 3 hrs. is needed to warm up the engine at air temperatures between about 14° to 8° F.

The illustration on page 589 shows a single-engined Junkers Ju.52 in Canada being warmed up in this way. Although two or three fabric-covered aircraft are burned up annually in Canada as a result of this method of warming up the engines, these losses are regarded as extremely small in view of the large number of such heating operations that are carried out. In the southern districts of the United States a special heater that is not so liable to cause fires is used, but it is said to be less effective.

A different method has been devised by engineers to fight the European winter. In this the engine is warmed up by electrically-heated air, and the illustration on this page shows the apparatus being used to warm up the engines of a Junkers Ju. 52/3 m. air liner. It works by blowing cold air through a set of heating spirals, and thence through tubes into the engine cowls, which are covered with strips of canvas.

The apparatus is designed to work on 220-volt A.C. supply, and absorbs about 12 kW. It is first heated up, and an internal temperature of approximately 392° F. is attained in about 20 min. when the tubes are coupled up. When the atmospheric temperature is about 21° F., the time required for warming up is about two hours, and rather longer is needed if there is a strong wind. This performance meets requirements in most cases, but in certain situations it has been improved by building electrical apparatus of higher power, absorbing up to 75 kW.

The problem of warming up also is being attacked by other means, and a petrol-consuming pre-heater that works on the principle of the Bunsen burner has been developed. This has about 10 times the heating capacity of the electrical device just described, and in practice has fulfilled every expectation. With only a short time for warming up, aero engines with which it is used start without difficulty, and the process of warming through the power plant of a twin or multi-engined air liner, ready for a safe take-off, requires only a few minutes.

The warming-up of an aero engine must always be done carefully, otherwise severe heat stresses are set up in the engine materials, with a consequent risk of cracks or seizure due to the unequal expansion of the parts.

We are indebted to the "*Junkers-Nachrichten*" for the information in this article.

Gloster Single-Seater Fighters

Developments in Speed and Climbing Power

THE Gloster Aircraft Co. Ltd. have specialised in the design and construction of single-seater fighters, and have produced many remarkably successful machines of this type that have been adopted by the R.A.F. One of the earliest of these was the "Grebe," a single-engined biplane, that in 1924 became the standard R.A.F. fighter, and was prominent in the equipment of the Force for several years. It was followed by the "Gamecock," which was designed for work at high altitudes. The "Gamecock" had a top speed of 159 m.p.h. at 5,000 ft., and could climb to 15,000 ft. in 10 minutes. It was adopted as the single-seater fighter for the 1926 programme of the R.A.F.

The Gloster "S.S.19" was introduced in 1931. In contrast to the wooden-built "Grebe" and "Gamecock," it was of all-metal construction, and was faster and could climb much more steeply than the previous types. It had a top speed of 176 m.p.h. at a height of 20,000 ft., and could reach that height in 12 min. 54 sec. In war enemy aircraft would have found the "S.S.19" a formidable foe as it carried six guns, two of which were synchronised to fire through the airscrew in the normal manner, the other four being mounted in the wings. The guns were arranged to concentrate their fire on a point between 100 ft. and 300 ft. in front of the machine, and any enemy aeroplane that had been manœuvred into the line of fire could scarcely avoid being hit in some vital part.

In 1934, when the Gloster company was taken over by Hawker Aircraft Ltd., the Air Ministry selected the Gloster "Gauntlet" single-seater fighter as one of the types for the re-equipment of R.A.F. fighter squadrons. The performance figures of this machine show a great advance on those of the "Grebe" of 1924. The "Gauntlet" is fitted with the 605 h.p. Bristol "Mercury VI.S." It has a top speed of 230 m.p.h. at 15,800 ft., and takes only nine minutes to climb to a height of 20,000 ft. The service ceiling is 33,500 ft. It is a day and night fighter, and its two Vickers guns are mounted in troughs, one in each side of the fuselage, and are easily accessible to the pilot. There are also racks to carry four 20 lb. bombs.

The equipment of the cockpit is very comprehensive, and in addition to the usual navigating instruments and the necessary gun sights and ammunition, it includes a wireless transmitter and receiver, night flying equipment, and a supply of oxygen. The undercarriage brakes can be operated either from the control column or by pedals attached to the rudder bar.

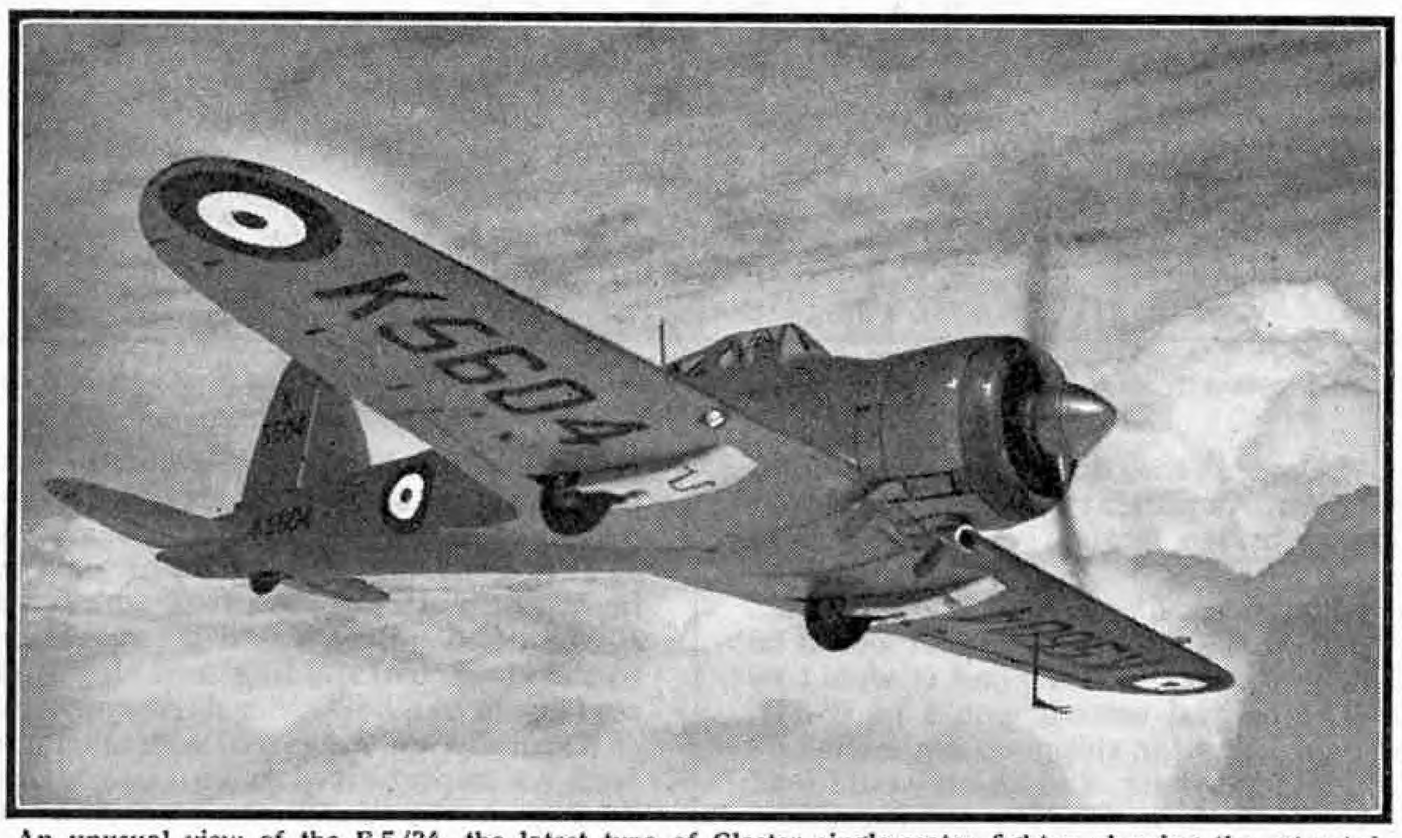


The Gloster "Gladiator" General Purpose Fighter, which has been adopted by the R.A.F. We are indebted to the courtesy of "Flight" for this photograph and for the one on which our cover is based.

A more recent Gloster type is the "Gladiator" general purpose fighter, and this also has been adopted by the R.A.F. It has been developed from the "Gauntlet," and although it carries more fuel and equipment it gives a much better performance. The engine is a Bristol "Mercury IX," rated at 695-825 h.p. and having a maximum of 840 h.p. for all-out level flight for five minutes fully loaded, and enables the machine to attain a top speed of 260 m.p.h. at 15,500 ft. The all-up, or loaded, weight is 4,400 lb., which is 450 lb. more than that of the "Gauntlet," but the new aeroplane takes only 9 min. 20 sec. to climb to 20,000 ft. Our cover illustration, which is based on a photograph taken from another machine by an official photographer of "*Flight*," shows a "Gladiator" shooting upward into the sky, and gives a vivid impression of the steep angle of such a climb.

The wings are built up of light steel spars and ribs, and the fabric covering is secured by a method of "wiring-on" that has been patented by the Gloster company. The framework of the fuselage is also of metal, and the forward part is covered with metal panels and the rear part with fabric. The fuel tanks are in the fuselage. This is heavily armed, and in addition to two machine guns placed like those in the "Gauntlet," it carries two mounted below the lower wing, one on each side. The lower guns fire outside the radius of the airscrew.

The Gloster aircraft mentioned so far have been biplanes, but the latest fighter produced by the company is a monoplane. It is shown in the lower illustration on this page. The newcomer is at present known as the F.5/34, and made its first flight only a few months ago. Details of its speed, rate of climb, and ceiling cannot be disclosed, but it is safe to say that in performance it excels previous Gloster fighters. Some of the factors that have made this possible are the adoption of the monoplane form with a retractable undercarriage, skilful streamlining of the fuselage, and the employment of a more powerful engine and a variable pitch airscrew.



An unusual view of the F.5/34, the latest type of Gloster single-seater fighter, showing the retracted undercarriage. Photograph by courtesy of "The Aeroplane."

The undercarriage wheels are partially withdrawn into recesses in the underside of the wings when the fighter is in flight, and they are arranged to take the full weight of the aeroplane in the event of a forced landing while they are retracted.

The F.5/34 is an all-metal low wing monoplane with stressed skin type of construction. The pilots' cockpit is covered with a sliding hood and is provided with means for heating.

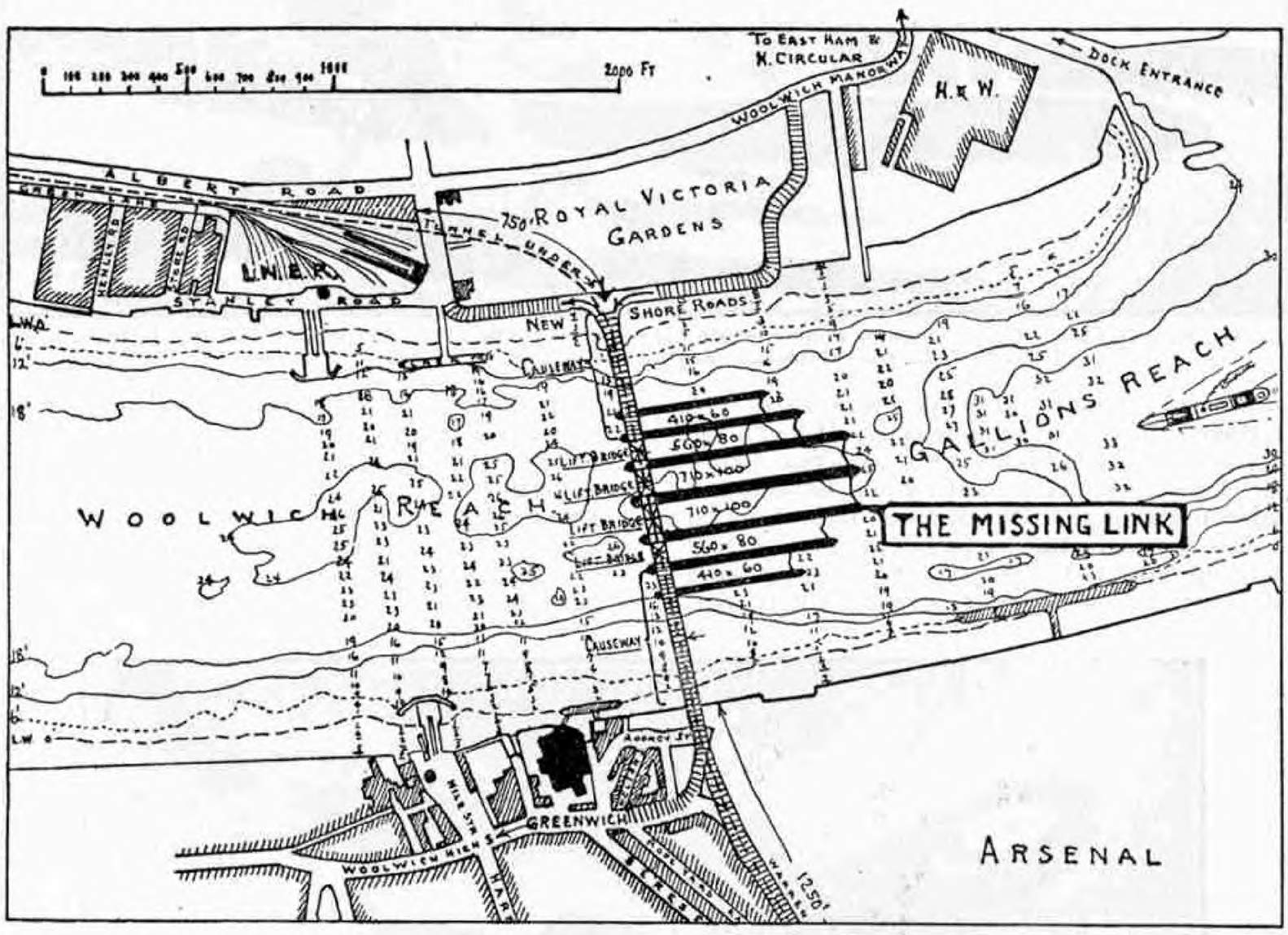
Making The Thames Tideless

The Proposed Barrage at Woolwich

GREAT interest has been aroused during the last two years by a suggestion to build a dam or barrage across the Thames at Woolwich. At present the river is tidal as far up as the weirs across it at Teddington, but if the scheme were carried out the tides would be held back by the dam, and a stretch of the river 29 miles in length would become a great lake or waterway of constant depth.

The suggestion of a dam is not by any means new. In 1858 Mr. H. Robinson proposed to build a dam at London Bridge. Nothing came of the proposal, but discussions on the effect of a dam continued and early in the present century, 1904-6, a determined effort was made to advance a scheme for a barrage at Gravesend, 16 miles farther down the river than London Bridge. Again nothing was done. One of the difficulties that prevented full consideration of the scheme was the chaotic condition of the London docks and wharves, which were not then under a single control. Now the entire river and its docks are administered by the Port of London Authority, which was formed in 1909; and the immense improvement that has followed has led to a revival of interest in the plans for the construction of a dam.

The present proposal was put forward early in 1935 by Mr. J. H. O. Bunge, M.I.Mech.E., who was the first to suggest a barrage or dam in Woolwich Reach. This position is shown on the map on this page, which indicates both the line of the structure itself and the size and position of the six locks by means of which vessels would be passed through it. The structure would be more than a dam, for both a road and a railway track would cross it so that it would greatly improve communication between the districts and circular roads north and south of the river. At present these are connected only by ferry, and the nearest bridge is the Tower Bridge, 10 miles farther up the river.



Plan of the proposed Thames Barrage in Woolwich Reach. It would be crossed by a road and a railway, and six locks would give access to the tideless river of constant level above it.

What the proposed dam would look like is well shown in the drawing reproduced at the head of the opposite page. It would be 1,500 ft. long, its greatest height would be 60 ft., and it would be divided into three sections. The central section would be 680 ft. in length, and would include six locks for shipping. On each side of it there would be causeways 410 ft. long, and these would lead to roads and railways on both north and south banks. Sluice gates in the causeways would provide for the overflow of excess water from the artificial lake above the dam.

There would be room in the central section for six locks. It is suggested that the two central locks should be 710 ft. long and 100 ft. in width, and that their floors should be 40 ft. below high water mark. The smaller locks on each side of this central pair would be 560 ft. long and 80 ft. in width, with a depth of 33 ft. All four locks would have lift bridges over them, to allow for the passage of vessels with a total height greater than that of the dam. It is calculated that they would suffice to pass through all the larger vessels now making use of docks above the site of the dam, with a total interruption of traffic across the structure by road or rail of little more than two hours a day, divided over the three to four minute waits during the raising of lock-end bridges for the passage of ships.

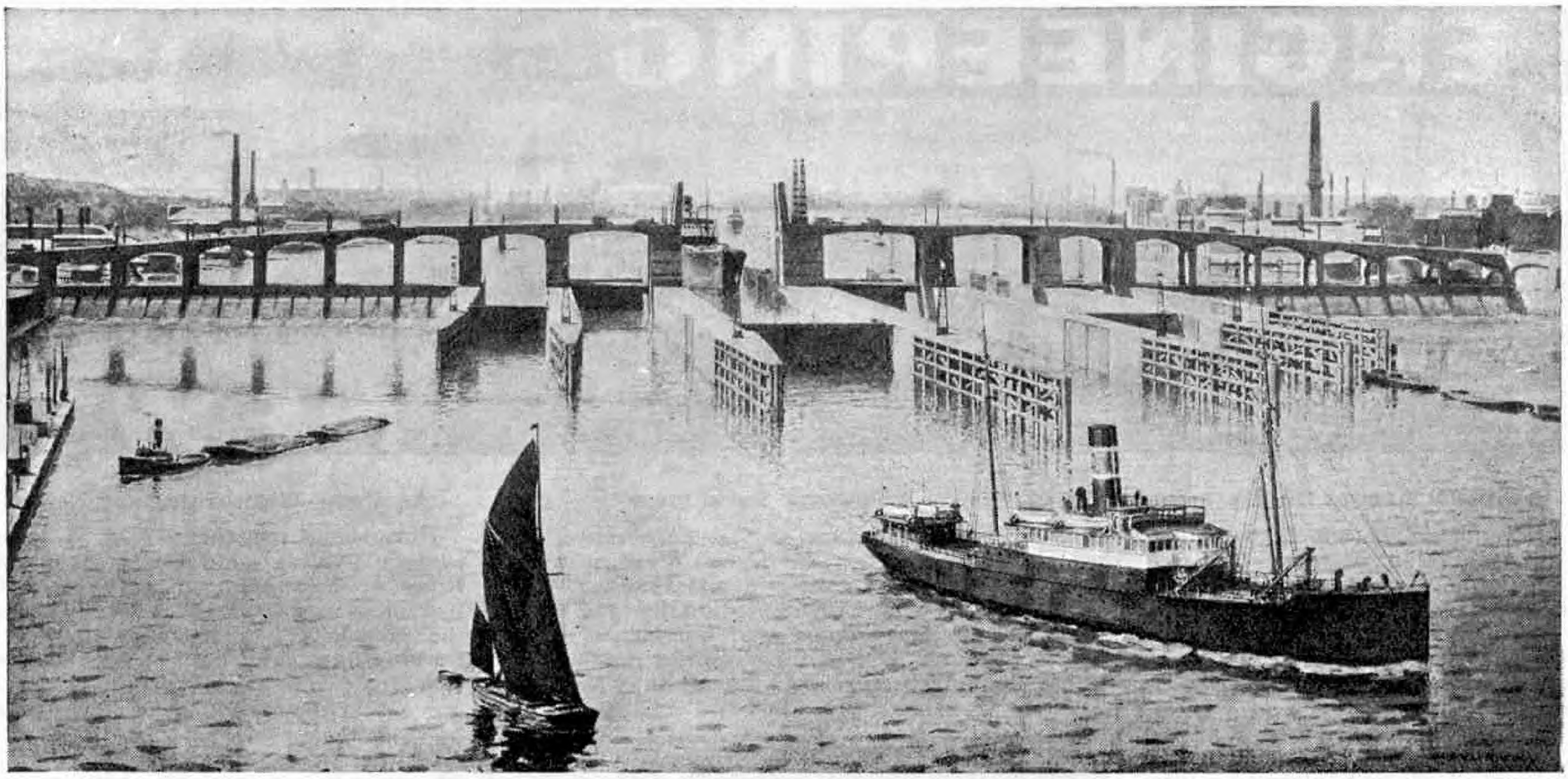
The minor locks on each side of the central section would have fixed arches and would suffice for smaller vessels. Their length would be 410 ft. and they would have a width of 60 ft.

Many advantages, it is believed, would follow the construction of the suggested dam. As the Thames from Teddington Weir to Woolwich would become an inland lake or basin of constant level, the mud flats that at present are seen at low water in many places would always be covered. Barges and other vessels would not have to remain moored at wharves and warehouses for long periods, waiting for the tides. Vessels would be able to enter the docks opening out on to this section of the river at all times, and not merely for a few hours before and after high water. Thus there would be no delay in dealing with both incoming and outgoing ships, for these would be able to pass through the locks of the dam at all states of the tide, as even at low water there would be 32 ft. of water in Gallions Reach, at the head of which the dam would stand.

As river traffic would be able to move about freely, and would not have to wait in barge roads and moorings, the width of the river available for navigation would be considerably increased. There would then be more room for pleasure and passenger boats and it is even suggested that one reach of the river could be made into an airport for flying boats or seaplanes. Battersea Reach has been pointed out as suitable for this purpose, as it provides 3,500 ft. of straight watercourse, with buildings only on one side. The water in the basin would be fresh, and not salt, as at present, and it would be cleaner, for the tides would no longer be there to stir up mud from the bottom, or to bring up sewage. Rowing and sailing would become more pleasurable, largely owing to the absence of the tide, and also would be safer, for the only current would be a slow natural river movement towards the dam sluices.

Naturally an extensive scheme for dealing so drastically with such an important port as London has aroused considerable discussion, in the course of which many objections have been raised. Some of these concern the exclusion of the tide. For instance, much has been made of the assistance that it now gives to barges that do not make use of tugs. This objection would have carried greater weight 30 years ago than it does to-day, for then only a quarter of the river-drawn traffic was towed, while to-day 85 per cent. is moved up and down the river in this manner. Tugs are cheaper than tide power and waiting for it and are ready to work at any hours.

Many people also have expressed the fear that if the tide were obstructed by building the dam, the water would pile up below the obstacle at high tide and overflow the banks there. That is not very likely, for the estuary is not sufficiently funnel-shaped to give

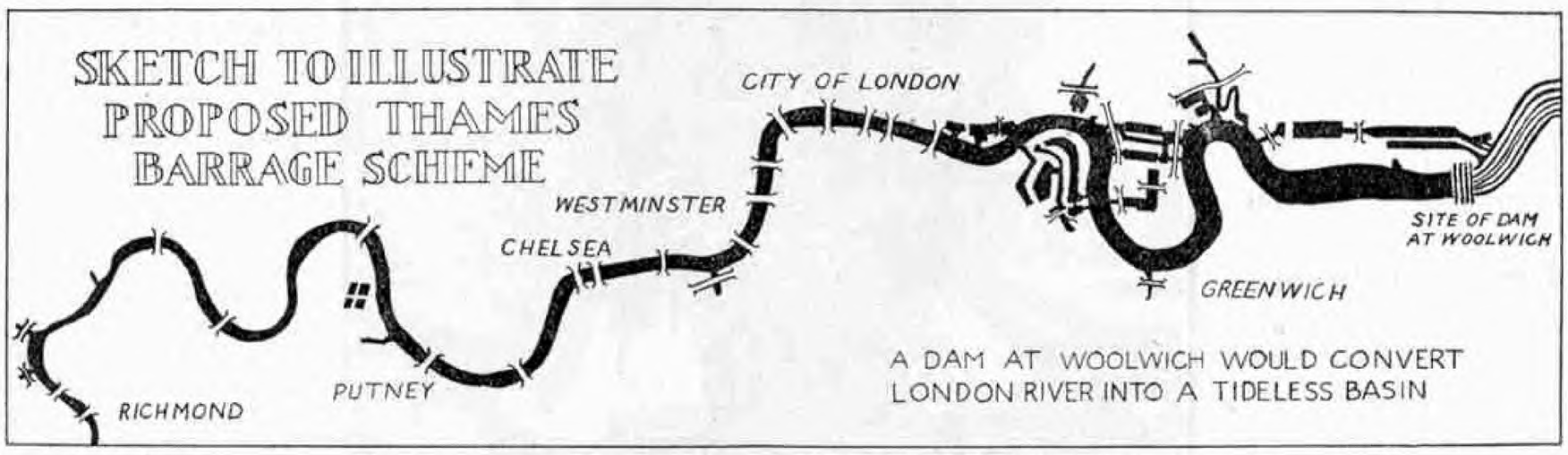


An artist's view of the suggested dam at Woolwich, as it would look from Gallions Reach. This illustration is reproduced from the picture by A. V. Anrooy, by courtesy of the Thames Barrage Association, to whom we are also indebted for the plan of the barrage on the opposite page.

rise to tidal waves, or even to cause the water to rise above the river banks.

Some objectors have suggested that there would be silting above the dam, because the scouring action of the tides would be lost. This is a very important point. In the past 25 years the Port of London Authority has dredged from the river 52 million tons of silt, and an increase in the amount deposited would add greatly to the cost of maintaining the port, and might eventually ruin it. But the foremost experts in the construction of dams deny that this would take place. The dam would only repeat on a larger scale the action of the weirs already existing at Teddington, and these have not caused increased silting in the river above or below them. In any case, the only silt that could enter the 29-mile lake would be that brought down by the river, and this could not amount to more than 1 ft. in 120 years.

There also would be no silting below the dam if the experience of Boston, in the United States, is to be relied upon. There a dam has been built across the mouth of the Charles River, the lower stretch of which has been changed from a dirty little stream to a splendid lake. The plan followed is similar in many respects to that proposed for the Thames, but there has been no need for dredging, either above or below the dam, since this was completed 31 years ago.



The constant level stretch that would be created by the construction of the Thames Barrage. This would make the river tideless for the length of 29 miles from Woolwich to Teddington, just above Richmond.

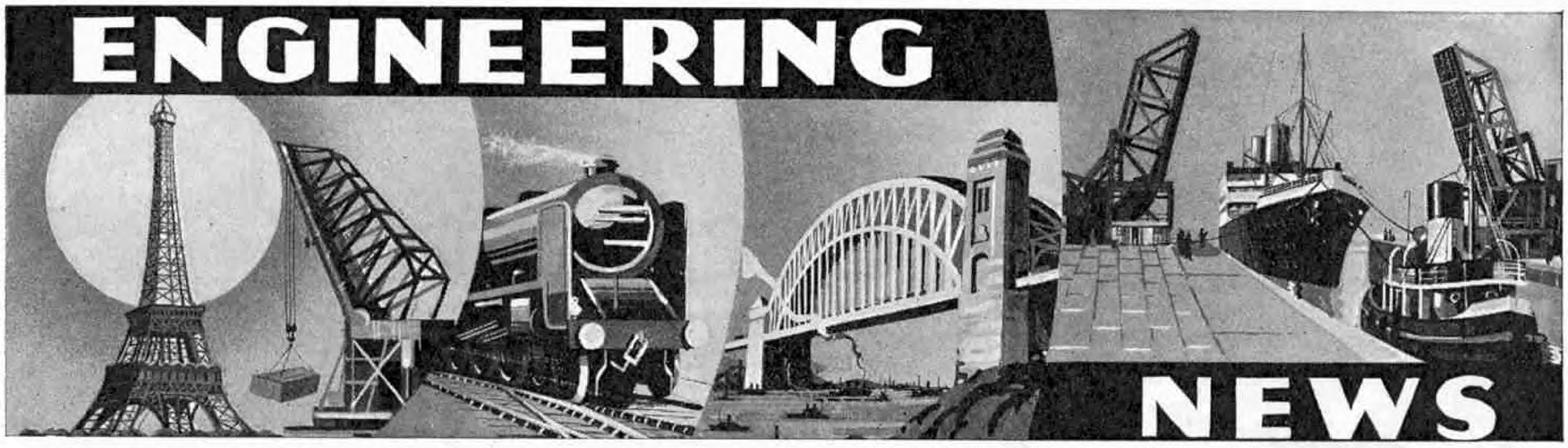
The effect of the dam on the pollution of the Thames would have to be taken into consideration before it is built. The rate at which the river flows seaward is comparatively low, and it takes 31 days for water falling over the weirs at Teddington to pass right through London. In the intervening period impurities and mud stirred up from the bottom oscillate backward and forward with the tide as the river makes its way slowly eastward, and there is little doubt that sewage discharged into the water tends to make it dirty and unhealthy. It is claimed that there would be less pollution if the dam were constructed, for only one-fifth of the sewage discharge of the Metropolitan area enters the river above Woolwich. The rest flows in below the site of the dam, and would be kept out of the city by it. The discharge above the dam would be steadily diluted night and day by the gentle current of fresh water, and purified by the oxygen dissolved in it, and a cleaner and pleasanter river worthy of the greatest city in the world would be the result.

One particularly interesting consequence of the creation of a great fresh-water basin of constant level in London would be better fire protection along the banks of the river. At low tide there is sometimes insufficient water to enable fire floats to leave their berths, and an extensive fire at such times might be very serious. On four occasions of major riverside fires during the last two years these could not be reached by the fire floats because they were unable to leave their berths or because there were many mud-bound barges between them and their objective.

The prevention of flooding also is claimed as one of the benefits that the scheme would bring. The river in London overflows when a high spring tide is accompanied by a strong north-east wind and a large flow of fresh water over the weirs at Teddington. Dredging does not remove this threat, but the sluices of the proposed dam would maintain a level above which any increases in the flow of water from up river could be stored during the time when the estuary level is higher than the said level, without overflowing the flood defences.

There is no question of the ability of British engineers to build the dam, which it is estimated would cost £4,500,000. They have been responsible for much larger structures of this kind in other parts of the world, and these have been designed to hold back water far greater in depth than the 20 ft. to 25 ft. of the proposed tideless London river. The estimated cost also is by no means high. Plans are now being discussed for dealing in other ways with many of the problems that it is suggested would be solved by the building of the dam. These plans include the construction of a great sewer through Kent to Dungeness to make the river cleaner, the provision of a tunnel between Dartford and Purfleet and of a high-level bridge at Woolwich to give easy communication between the two sides of the river, and the building of a new dock. Advocates of the dam scheme point out that these plans would involve a total expenditure of more than £80,000,000, and claim that their own proposals would give all these benefits and others at one-twentieth the cost.

For the information contained in this article we are indebted to Mr. J. H. O. Bunge, M.I.Mech.E., Secretary of the Thames Barrage Association.



New Metal Absorbs Oil like a Sponge

As a result of efforts to produce an entirely self-lubricating bearing, the Chrysler Corporation of America has manufactured a new metal compound that absorbs and holds oil like a sponge. If a piece of the metal after oil treatment is subjected to pressure the oil oozes out in big drops.

The new material, which is known as "Oilite," appears to solve the problem of efficient lubrication very effectively and it is now being manufactured into bearings of all kinds and sizes.

A Heavy Crane Lift

One of the heaviest single loads ever lifted into a ship was put aboard the liner *"City of Exeter"* at Capetown recently. It was a stator weighing 65 tons, which was being sent to England for repairs, and it was accompanied by another piece of machinery weighing 17 tons. As no crane capable of taking such a heavy lift was available, the port's floating crane, which is designed for lifting weights up to 60 tons, was used, special precautions being taken to prevent accident.

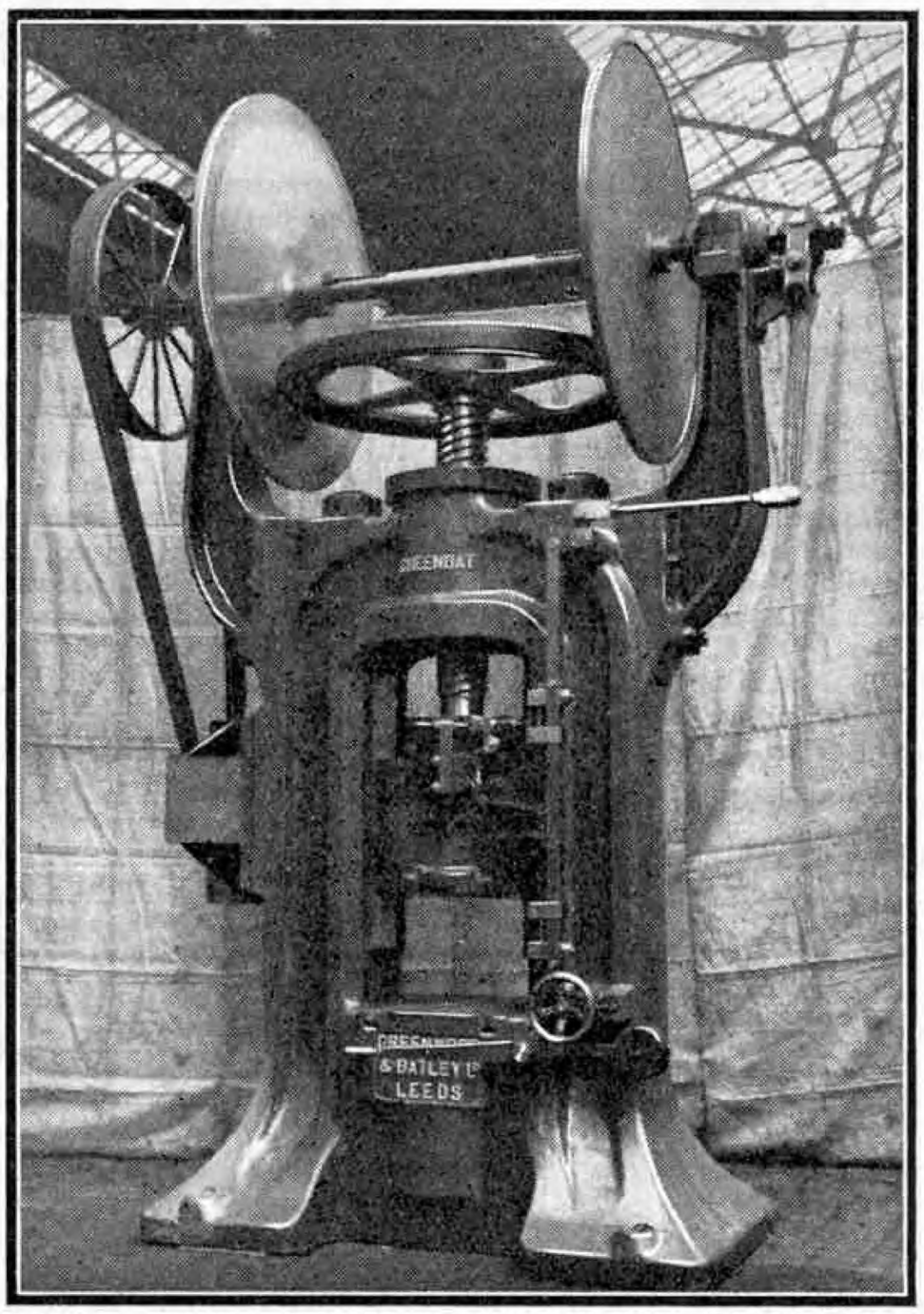
At first it was intended to make a tug boat fast to the crane pontoon to act as a counterweight when the crane took the load, but eventually it was decided to use the 17-ton piece of machinery as a counterweight. This was placed on the pontoon and was found very satisfactory, the great lift being accomplished without any hitch.

Panama Canal may be Enlarged

It is expected that improvements to the Panama Canal will become necessary during the next few years owing to increase in traffic, and plans are now being made in Washington for this purpose. The existing locks on the Canal are capable of handling a maximum of 26 ships daily, and during 1936 the Canal was used by 5,832 ocean-going vessels. If the scheme now under consideration is carried out, new locks will be built in order to increase the number of ships that could be passed daily through the waterway. The scheme suggested is of an extensive nature and probably would not be completed before 1960. In addition to the construction of the new locks, the existing locks and their equipment will be modernised and other improvements effected. The estimated cost of the scheme is approximately £30,000,000.

A Powerful Screw Press

The illustration on this page shows a 220-ton high-speed screw press manufactured by Greenwood and Batley Ltd., Leeds, and designed primarily for the production of steel and non-ferrous hot pressings. It is suitable also for producing stampings from cold metal, in which a concentrated heavy pressure is required, as it is a feature of a screw press that the maximum pressure is applied at the end of the stroke.



A 220-ton screw press, in which the screw is driven by metal friction discs. It is suitable for producing either hot or cold pressings. Photograph by courtesy of Greenwood and Batley Ltd., Leeds, the makers of the machine.

The press delivers 12 strokes per minute, and the screw, which is 7½ in. in diameter, carries at its upper end a steel friction disc that makes contact with driven friction discs operated by a 10 h.p. power unit. A band brake and a spring reversing stop also are provided, the brake acting as the slide approaches its top position and being released automatically as the downward working stroke commences.

An Under-Water Tunnelling Record

During the construction of the great Lincoln Highway Tunnel under the Hudson River at New York, a new record for tunnelling in soft ground has been set up, the contractors boring 1,040 ft. in 25 working days. The bore under the river, 5,060 ft. in length, was completed in seven months. The average daily advance was 40 ft., or 16 rings of iron lining, the maximum advance recorded in any one working day being 47½ ft.

The Tunnel will be two parallel bores in line with Thirty-ninth-street, New York. Each bore will have a diameter of 31 ft. over the cast iron lining, or 28 ft. inside, with a paved roadway 21½ ft. wide, and a narrow service walk on one side. Fresh air will enter the tunnel through a large duct below the roadway, from which flues will lead up behind the roadway kerbs, and the exhaust duct will be above the ceiling. The ventilating plant consists of 25 blower fans and 25 extractor fans, which will be accommodated in three towers.

When the first of the tunnels is completed it will be used by traffic in both directions until the completion of the second tunnel.

Giant Floating Crane for Manchester

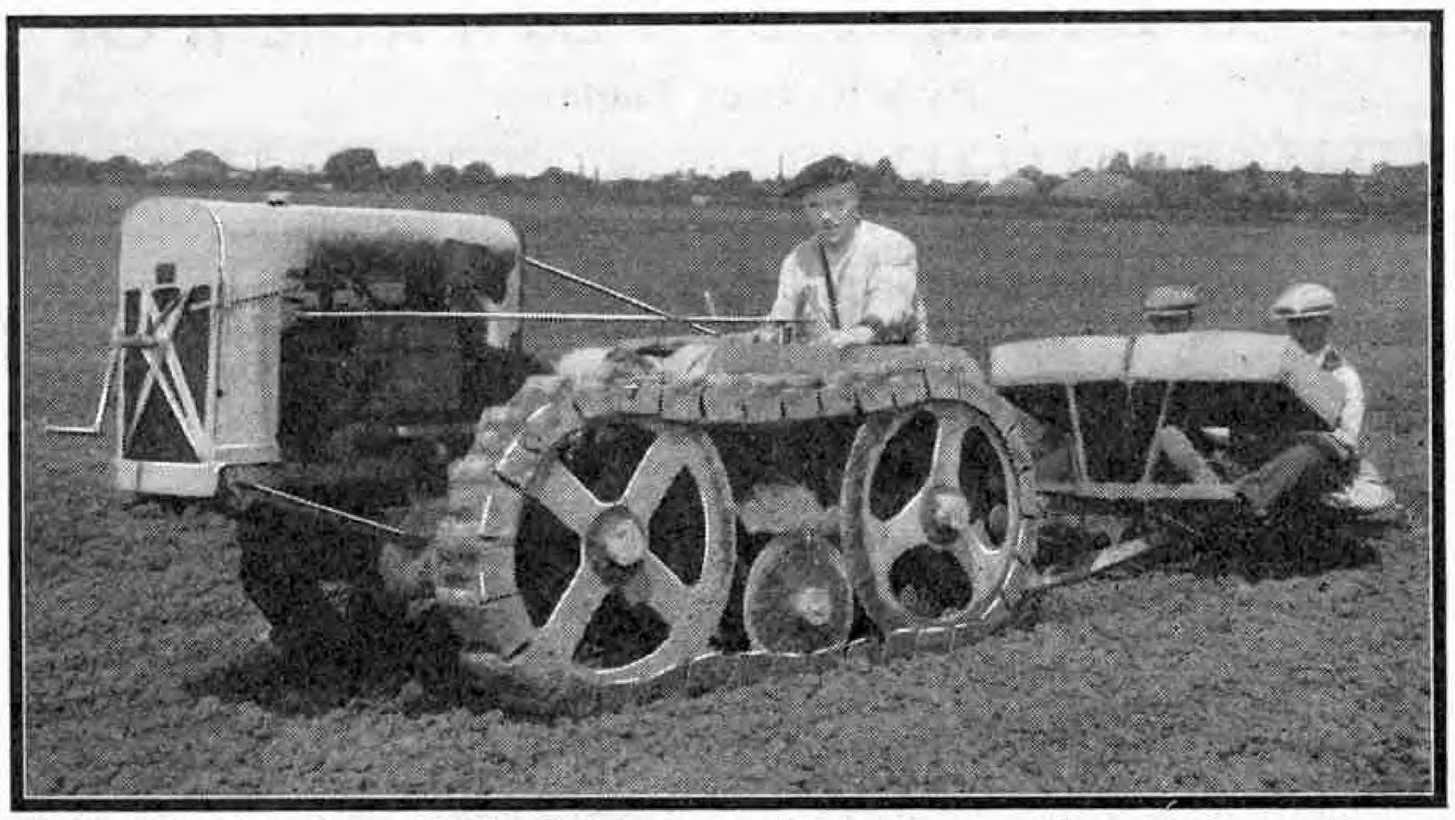
The Manchester Ship Canal Company recently took delivery of a giant floating crane of 1,150 tons displacement, specially designed for lifting 250-ton lock gates, engaging in salvage operations and handling general cargo up to 120 tons. The massive pontoon on which the crane is mounted has an overall length of 147 ft. and a width of 44 ft. 3 in., and is provided with two auxiliary pontoons that considerably increase its stability under load. A 150-ton ballast tank counterbalances the slewing of the jib. The crane is electrically operated, current for the motors being generated by a 200-h.p. steam generator set. The crane was built by Werf Gusto, Schiedam, Holland.

Traffic Control at Piccadilly Circus

A complicated system of traffic signals that is now being installed at Piccadilly Circus, London, will be ready for operation this month. This installation is claimed to be the highest development yet made of the vehicle-actuated light-signal control system, for Piccadilly Circus is one of the most complicated junctions in London. Traffic on all the streets adjoining the Circus will be controlled by the new system.

Oil-Engined Tractor with Novel Track

The upper illustration on this page shows a "Crawler" light agricultural tractor, designed and built by Messrs. Bomford Bros., Pitchill, Evesham, a prominent West-Midlands farming firm, who have developed an engineering side to their business. It is powered by a Victor two-cylinder oil engine, made by Victor Oil Engines (Coventry) Ltd., Coventry, and is equipped with crawler tracks that are constructed on what is believed to be a new principle. Each track consists of a number of shoes clamped to two steel cables, the underside of each shoe carrying a cross-piece provided with long guides on which the cables bear. The tracks are driven by a series of discs mounted on spindles set between the two plates of which the driving sprockets are formed. These discs are free to turn, and they guide the cross-pieces into position as the tracks run on to the driving sprockets. A constant tension of about 5½ cwt. is maintained in the tracks by springs.



This illustration shows the special "Crawler" tractor described on this page, pulling a planting machine on a farm. For this illustration we are indebted to Bomford Bros., Pitchill, Evesham.

The basis of the tractor frame is a deep channel-section steel rectangle, the engine being mounted at the extreme front, where it forms a unit with the clutch and four-speed gear-box, which consists of proprietary components. From the gear-box a jointed shaft transmits power by an overhead-worm through a differential to a cross-shaft, which is connected to the rear track sprockets by two Duplex roller chains. The tractor is steered by altering the speeds of the two tracks relative to each other by means of brakes acting on drums on the half shafts.

The tractor weighs 32 cwt., and is capable of maximum and minimum speeds of about 8 m.p.h. and ¾ m.p.h. respectively.

Solidified Fuel for Petrol Engines

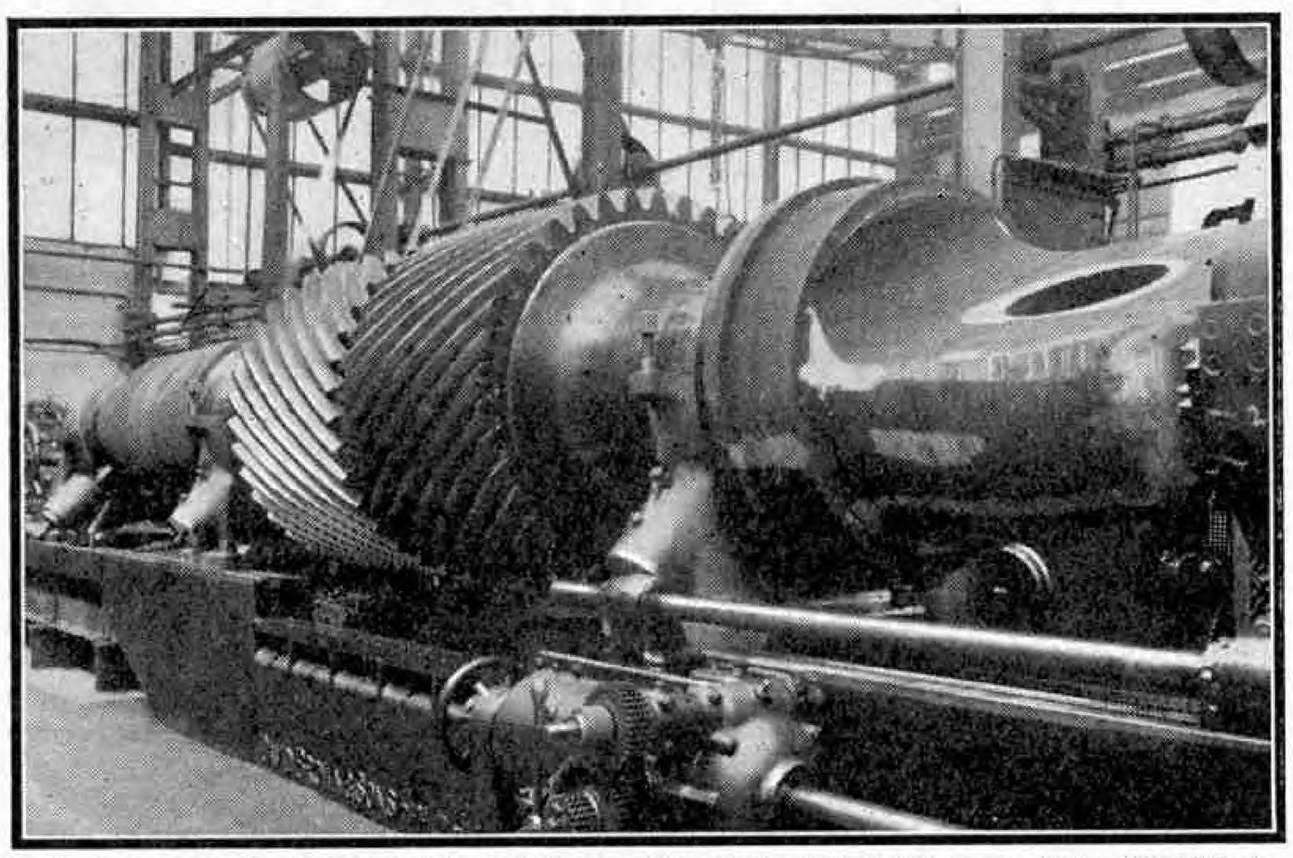
After many years of experiments Dr. Prussin, of New York, has succeeded in producing solid petrol. This fuel is in the form of a reddish paste or jelly. When tested at New York University in connection with a single-cylinder engine, it proved as effective and efficient as liquid petrol, and was found to be considerably safer in use.

Suspension Bridge for New York

A further bridge is to be built over East River, New York, about five miles upstream from the present Triborough Bridge, and preliminary contracts have already been placed. The new structure will be known as The Whitestone Bridge and will be of the suspension type, with a central span of 2,300 ft. and two side spans of 735 ft.

Progress on Table Bay's New Harbour

Work on Table Bay's new harbour scheme, which was referred to in the "*Engineering News*" pages of the June 1937 "*M.M.*," is going steadily ahead. Divers working 40 ft. below the surface are now laying rails preparatory to a start being made on the concrete foundations for the new 2,400-ft. foreshore quay. The divers are working in a huge trench 12 ft. deep, 40 ft. wide, and 600 ft. long, cut by a rockbreaker from the solid base of Table Mountain. In addition to the rock-breaker vessel the bucket dredger "*Delver*" is at work continuing the trench, removing sand and shingle in order to expose the rock bottom. When the trench is completed huge cement blocks, weighing from 10 to 25 tons each, will be laid in it by the dredger "*Labrus*," which it is expected will be able to lay 60 blocks in 24 hours.



Cutting the teeth of a giant double-helical pinion at the works of David Brown and Sons (Hudd) Ltd., Huddersfield, to whom we are indebted for our illustration. The pinion is one of two for a large plate rolling mill, and weighs 30 tons.

About 500,000 tons of rubble have been dumped to form a spit of reclaimed land, which extends about half a mile into the water. Through this spit a cofferdam 1,200 ft. long and 40 ft. deep at its seaward end is being cut, and in it pipe lines to serve a new power station will be laid. Over 40,000 tons of rock and 100,000 tons of earth have to be removed before the pipes are laid.

30-Ton Pinions for Steel Rolling Mill

The lower illustration on this page shows the tooth-cutting operation in the works of David Brown and Sons (Hudd) Ltd., Huddersfield, on one of two giant pinions for a large plate-rolling mill. The pinion shown is in one piece with its shaft, which is nearly 23 ft. long, and carries at its remote end the main driving wheel.

Each pinion weighs approximately 30 tons, and on account of the unusual length of the pinion shaft, the bed of the machine was augmented by a fabricated auxiliary structure, which made it possible to give the pinion maximum support. The "set-up" includes a chuck at the coupling end, a centre at the remote end and three massive roller steadies.

The pinions are made of nickel chrome steel and each has 38 double-helical teeth of 3¾ in. circular pitch, while the width of the working face is 71 in. The pinions do not operate at a very high speed, but extreme accuracy in cutting the teeth was necessary to ensure that no "end slogger" or thrust will be imparted to the main driving gears when they are in service.

Large Dredgers for work on Mississippi River

The Engineer Corps of the United States Army, which is responsible for maintaining the navigable channel in the Mississippi River, has put into service two additional large hydraulic cutter or suction dredges. These will be used to remove shoals and bars, and widen and deepen the channel where this has been made necessary by the continual silting and shifting of sand. They are 266 ft. long, 50 ft. beam and 8½ ft. deep, and the hulls are made of welded wrought iron plates. Each vessel is propelled by oil-electric engines driving twin screws that work in tunnels fitted with large hatch covers, so that the blades can be renewed without the necessity for dry-docking the vessel. Four balanced rudders are provided for ahead and astern movements.

The dredging ladder, carrying the suction pipe and motor-driven cutter, is adjusted by a topping lift from a steel frame and boom, with electric winch and the cutter is driven by a 300 h.p. motor. At the stern is a 20 in. elbow for connection to a floating discharge pipe. Pumping is carried out by a 20 in. centrifugal pump driven by a six-cylinder, two-cycle oil engine.

Two main generator sets of 400 and 200 kW respectively, are driven by a 650 h.p. engine. When dredging, the larger generator serves the cutter motor, and the smaller one serves the spud and hauling winches.

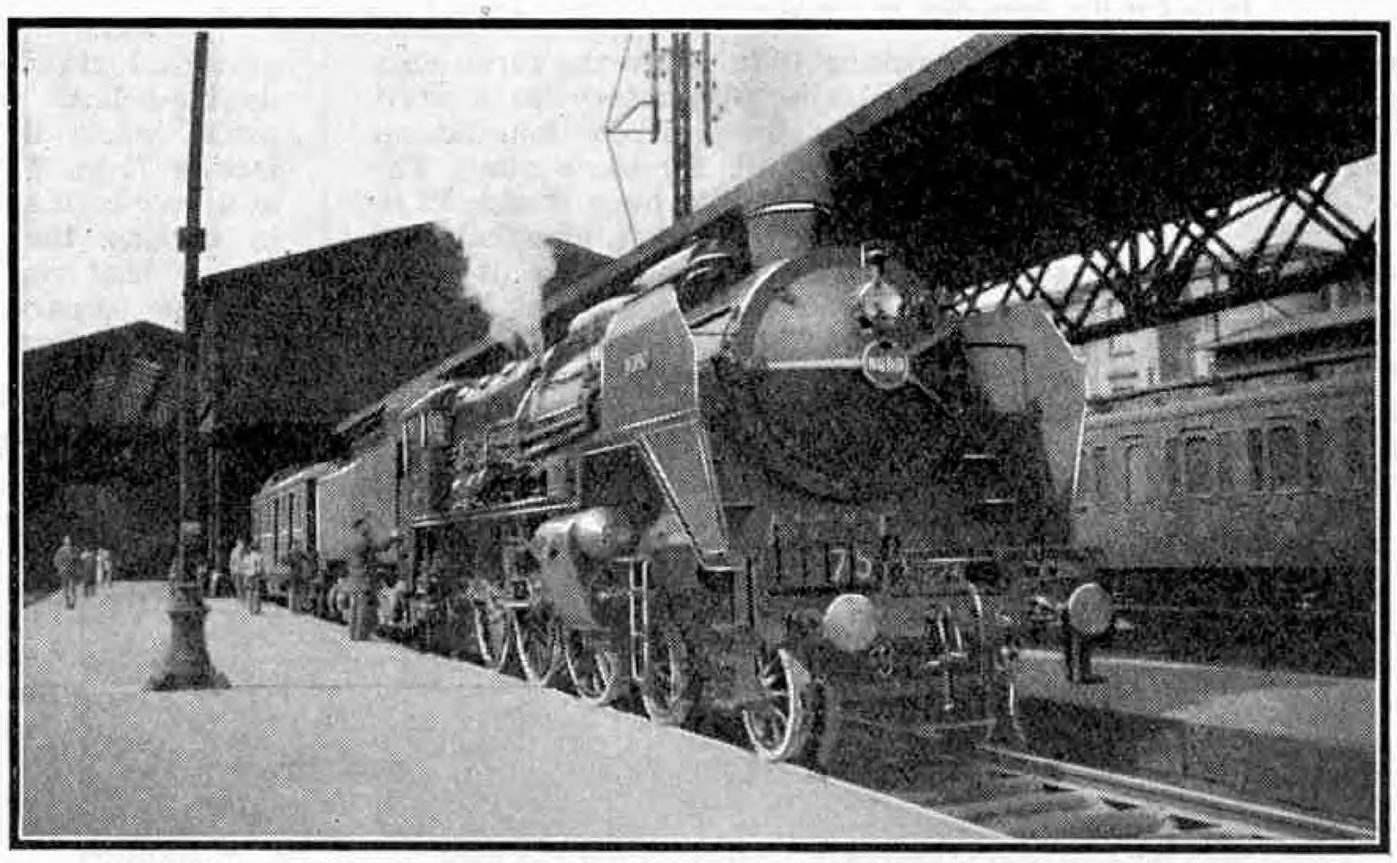
On the Footplate of a French "Pacific"

Paris to Boulogne by *"La Flèche d'Or"*

By a Railway Engineer

THE romance connected with the great named trains of the continent of Europe has in recent years received both a fillip and a touch of the bizarre from the writers of detective fiction. The *"Orient Express"* and the *"Blue Train"* have been portrayed as the scenes of wild and mysterious happenings, and in consequence many English people who have not had the good fortune to travel abroad have come to associate them with the land of make-believe rather than that of Bradshaw. But no mystery or detective story, however intriguing, can for sheer compelling interest vie with a place in the engine cab of one of these famous flyers—at least so I found it during some recent journeys in France, when I was privileged to ride on the footplate of that most famous of trains *"La Flèche d'Or"* (*"The Golden Arrow."*)

On its northbound run this express leaves the Gare du Nord at 10.30 a.m. Shortly before starting time our own engine came backing slowly down; this was No. 3-1274, a Nord "Super-Pacific," in charge of Driver Michaux and Fireman Calmels of Calais shed. I was cordially greeted by Locomotive Inspector Baudry, who had come down from Calais specially to accompany me on the footplate; and although he could not speak English at all, and my own French was rather shaky, especially on technical terms, he managed to make beautifully clear to me the working of the great engine. At first glance the principal cab fittings are not so very different from those of a modern British locomotive. One quickly grows accustomed to the metric units displayed on the various dials, to a speed indicator reading in kilometres per hour, to steam gauges registering pressure in hectopiezes instead of lb. per sq. in.; but closer acquaintance reveals some striking differences.



Nord "Super-Pacific" No. 3-1274 at Paris before the start of the run described in this article.

Much the most important of these is the actual method of controlling the engine. These "Super-Pacifics" are of course four-cylinder compounds, but they can be worked either as compounds or simples, entirely at the discretion of the driver. Two regulator handles are provided, one working over the top of the other on the quadrant plate; the outermost handle is used for admitting boiler steam direct into the low-pressure cylinders, and the inner handle used alone gives ordinary compound working. The adjustment of cut-off in the high and the low-pressure cylinders is done by means of independent gears, thus differing from all British compounds, in which both sets of valve gear are linked up simultaneously by one reversing screw.

The cabs of these engines are quite roomy, though rather severe compared to modern English ideas (there are no such luxuries as seats for the driver and fireman) but they certainly boast of one refinement that I have never heard of in this country—electric light. The last few minutes before starting time were spent in donning various shields against the ravages of coal dust. Previously when travelling in France I had noticed that all the express drivers wore goggles, so I took care to provide myself with some.

Our train consisted of five Pullmans, two sleeping cars and two heavily-freighted vans, yet such is the weight of Continental stock that we had a load of no less than 447 metric tons behind the tender; this is equal to 442 English tons, and the gross load, with passengers and luggage was 460 tons. On a descending gradient of 1 in 250 we made a very rapid start. Working on 45 per cent. cut-off in the high-pressure cylinders, and 62 per cent. in the low, the engine accelerated with scarcely a sound.

I was standing on the left-hand side of the footplate just behind the driver. In front of me a fascinating array of gauges showed exactly what was happening at all critical parts of the engine—the pressure of the steam when actually entering the high and low-pressure cylinders, the temperature of the steam after passing through the superheater, and most interesting of all, the speed. The speed indicator is fixed right in front of the driver, just ahead of the reversing screw. Beyond St. Denis the needle just touched 107, that is 67 m.p.h., and then we began the 13-mile ascent at 1 in 200 to Survilliers.

We had scarcely begun climbing when a slowing to 50 m.p.h. was necessary for permanent way work; but here, as at every other speed restriction, both permanent and temporary, the driver displayed the greatest care and brought the pace well below the limit required. In this case we slowed up to 42 m.p.h. Now, to recover speed on the 1 in 200 gradient, the regulator was altered to give simple working, and with cut-off in the high-pressure cylinders increased to 47 per cent., No. 3-1274 picked up in magnificent style. When working as simple these remarkable engines have a tractive effort of no less than 50,000 lb., that is 25 per cent. greater than that of Crewe's mightiest, No. 6220, *"Coronation."* At the same time the Nord "Pacifics" cannot, when working simple, utilise anything like their full boiler pressure; and now steam was entering each pair of cylinders at a bare 50 lb. per sq. in. compared to a boiler pressure of 240 lb. per sq. in.

But this low-pressure long cut-off method of working produced a most remarkable result. At Goussainville, four miles beyond the site of the slack, we were doing 56 m.p.h. On the tiny strip of level track through the station the engine raced away to 60 m.p.h., and then proceeded to accelerate still further on the continuation of the bank to a steady and unvarying 61 m.p.h., even though cut-off in the high-pressure cylinders had been reduced to 42 per cent. as we passed Goussainville. So we breasted the summit, and were through Survilliers, 18.4 miles, in 21¾ minutes from Paris, a remarkable time in view of the intervening slack.

Once over the top Michaux changed over to compound working, we accelerated like lightning, and then, for the 1 in 200 descent to Creil, the main regulator was brought back to such a position that the low-pressure cylinders were cut out altogether and the engine operated as a two-cylinder simple. Using the merest breath of steam we were soon tearing downhill at the legal maximum speed, 75 m.p.h.; indeed, beyond Orry-la-Ville we got up to 77 m.p.h., but the brakes were quickly applied to bring our rate within the limit. The engine rode superbly; I have rarely experienced a quieter footplate journey, and when talking to M. Baudry I scarcely had to raise my voice. So we swept down through the Forest of Chantilly, over high viaducts, among beautiful woodlands, until we were nearing Creil. Here the Calais route parts company with the line to St. Quentin and the Belgian frontier, and the boat expresses have to slow up to 55 m.p.h. over the junction.

We were through Creil, 31.2 miles, in 31½ min. Just beyond the station a directional route indicator showed unmistakably the line we were to take, and this sign was surmounted by an illuminated number indicator, displaying the figures 90, the speed limit over our particular route. Climbing is resumed at once and continues with scarcely a break for the next 23 miles, but working full compound now the engine got going in great style. Speed rose, up a 1 in 415 grade, to 64½ m.p.h. at Liancourt; the slight dip before Clermont

brought us up to no less than 73, and then the rate settled down to a steady 62½ m.p.h. up the 1 in 250 towards St. Just.

Driver Michaux never varied the cut-off in the low-pressure cylinders, keeping it at 62 per cent. all the way; while during this splendid ascent the main regulator stood just beyond the half-way point on the quadrant. Working thus steam was entering the high-pressure cylinders at 170 lb. per sq. in., and, after passing through the intermediate receiver, entering the low pressure at about 55 lb. per sq. in.

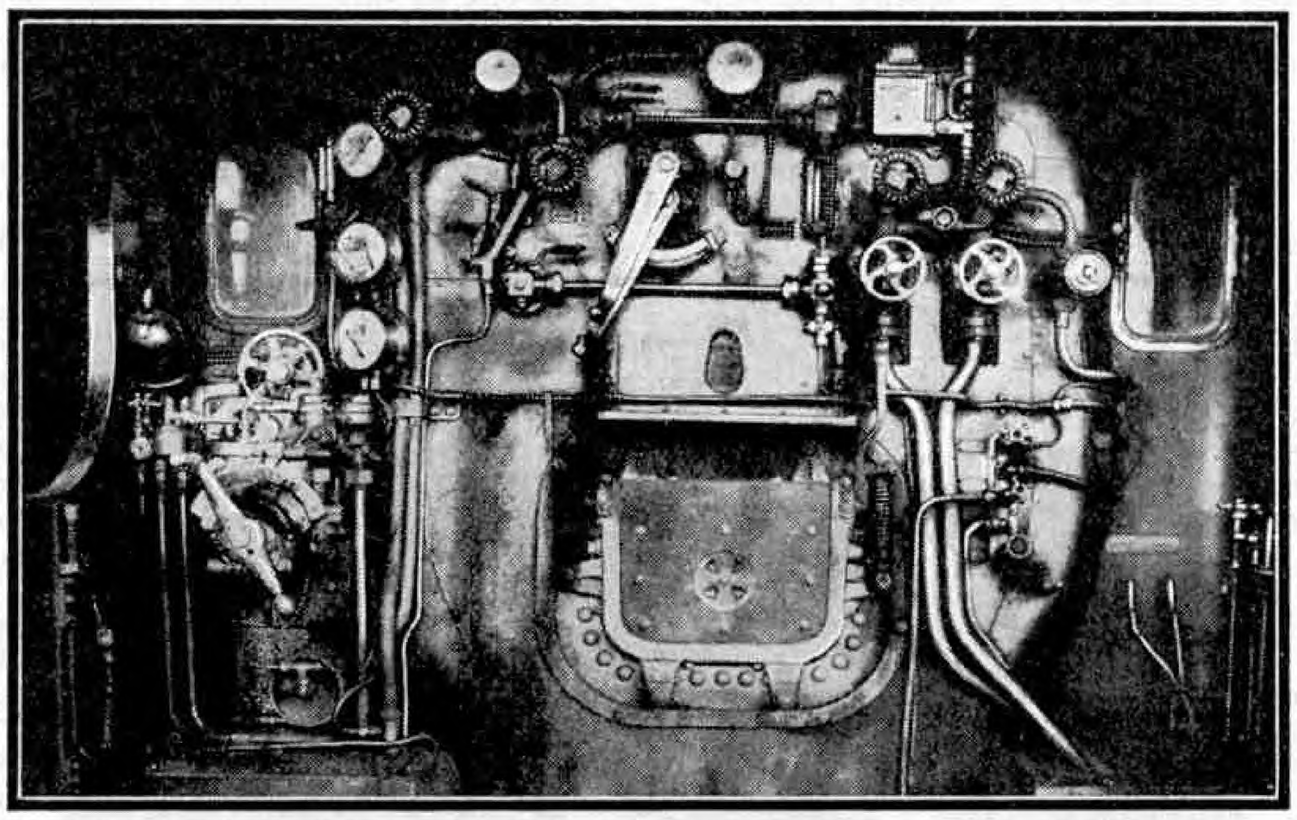
By now we were breasting the summit at Gannes, having covered the 23 uphill miles from Creil at an average speed of 65 m.p.h. High-pressure cylinder cut-off was reduced to 35 per cent., and by bringing the regulator back just inside the half-way position the low-pressure cylinders were once again put out of action. In spite of this easy working we were soon bowling downhill at 70 m.p.h. The section throughout from Creil to Amiens is equipped with automatic colour-light signals, and the speed limit has been raised from the standard 120 to 130 kilometres per hour.



A splendid view of the "Flèche d'Or" headed by a "Super-Pacific" No. 3-1254 near Orry-la-Ville. Photograph by Mr. G. F. Fenino, of Ablon, France.

All this time I had been greatly interested in the firing. Two different grades of fuel are carried. On all the harder stretches coal is used, but coal of a quality that might well cause an English fireman to despair of ever getting the safety valves to blow off; this small, very dusty stuff is carried in a kind of hopper that discharges the coal conveniently for the fireman. In addition a supply of briquettes is carried. These consist of coal dust compressed into large blocks and impregnated with a very small quantity of oil and they are stacked in a sort of cage on the left-hand side of the tender. But in spite of the fuel the engine appeared to be supremely easy to fire. Calmels was putting most of the coal just under the door, and only very occasionally did he indulge in the kind of careful placing that one invariably sees on an L.N.E.R. Gresley "Pacific."

On the descent from Gannes towards Amiens briquettes were used; they were cracked in two with a hammer and then just thrown in by hand. As might well be imagined, the fire-box of these engines is of outstanding efficiency; it is straight-sided, and very long, and is one of the most prolific steam-raisers I have ever had the privilege to observe. No matter how heavy the demand for steam the pressure gauge needle seemed an absolute fixture at a pressure of 17 hectopiezes, that is 242 lb. per sq. in.



A cab view of one of the "Super-Pacifics" showing the principal fittings, including the twin regulator handles. Photograph by courtesy of the Northern Railway of France.

Down past La Faloise and Ailly-sur-noye we were doing a steady 73 to 75 m.p.h., but after passing Dommartin, 72.3 miles from the start, in 67¾ minutes, the driver turned round to me, shook his head and remarked "Trop vite." We were getting so far ahead of time that the engine was now deliberately slowed down in order not to pass through Amiens too early. A curious point in the observance of all the slacks, even the very severe one through Amiens, was that steam was never shut off; speed was brought down to the prescribed figure entirely by means of the brakes. Although speed had been eased to 50 m.p.h. at Boves, and the approach was scrupulously careful, we were through Amiens, 81.1 miles from Paris, in exactly 78 minutes, two minutes early.

We passed through the big station at 20 m.p.h., and then with the brakes released, and the high pressure cut-off lengthened to 47 per cent., the engine got away very smartly, working compound. Almost immediately we entered the first of a series of short tunnels. After being accustomed to a complete black-out, or at the best a glare from the fire, to pass through a tunnel with electric light on in the cab was a novel experience; it revealed an atmosphere thick with smoke and swirling clouds of coal dust, and gave one the feeling of being down a mine, shut off from the world above. Lighting is absolutely essential on these engines; they are run with the fire-doors completely shut and not a chink of light escapes, so that at night the driver needs something in order to see the speed indicator. In addition to the main lamp in the cab roof, a second lamp is provided, suitably shaded, that shines direct on to the speed indicator.

We emerged from the last of the tunnels accelerating very rapidly, and at Ailly-sur-Somme, only five miles beyond Amiens, we were already doing 69 m.p.h. Round an almost continuous succession of reverse curves the engine bowled along as smoothly as many a coach; Picquigny was passed at 72 m.p.h., and then at Hangest there came a severe slack over an underline bridge in course of repair. We slowed up to 30 m.p.h., but once over the affected length, working full compound, with 42 per cent. cut-off in the high-pressure cylinders, No. 3-1274 picked up even more brilliantly than is usual with these remarkable engines.

At Longpré, four miles farther on, we were doing 63 m.p.h.; at this point cut-off was reduced to 38 per cent., but the engine continued to accelerate until reaching 72 m.p.h. at Pont Remy. There was a slight easing to 64½ through Abbeville, and then, still going on 38 per cent., we went ahead again to maintain an average speed of 70.7 m.p.h. over the 27.9 level miles from Abbeville to St. Josse.

We were now running two minutes early, and were through Etaples, 140.6 miles from Paris, in 134 minutes. The regulator was now pushed well beyond the half-way line, and on gradients rising at 1 in 500 to 1 in 385 we recovered splendidly to 65 m.p.h. at Dannes-Camiers; then came the stiff 3-mile bank at 1 in 133 up to Neufchatel. Regulator and reversing gear were untouched, and yet we sailed over the crest of the bank at 54½ m.p.h., a drop of only 10 m.p.h. in 3 miles of 1 in 133.

Once over the top cut-off was reduced to 35 per cent. and the low-pressure cylinders were put out of action altogether, but we were soon tearing downhill in thrilling style. Neufchatel station was passed at 65, another mile and we were up to the legal maximum, but the moment we touched 75 m.p.h. Michaux applied the brakes, and we ran on through Hesdigneul at 66. We were so well before time now that the regulator was brought right back and the engine allowed merely to "roll" onward to journey's end; but then, as we neared Boulogne, signals were against us, for the first time.

We crept from signal to signal all through Boulogne yard, until at last the road into the town station was clear. We arrived at Boulogne a minute and a half late, in 156½ minutes for the 157½ miles from Paris. Making allowance for the two permanent way slacks as well, the net time works out at 148 min.

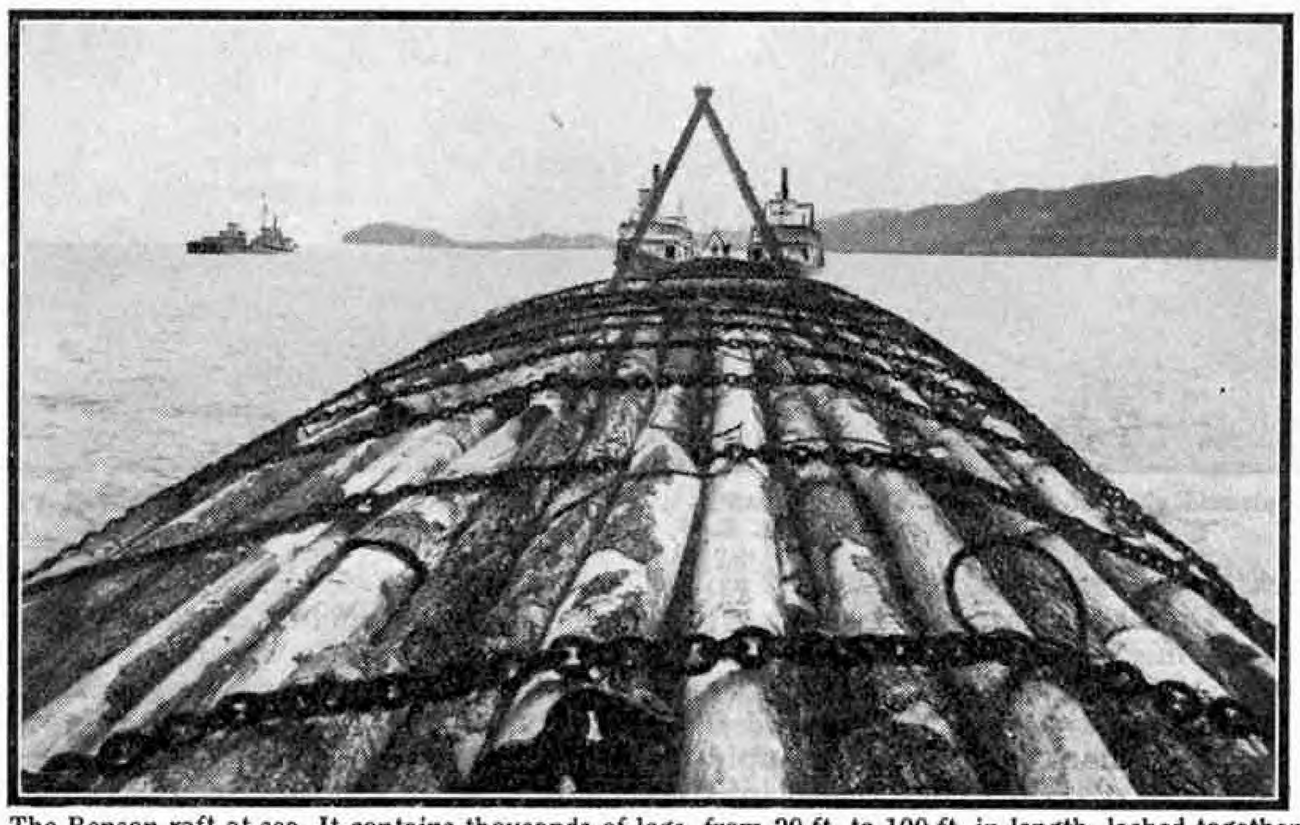
We stood for just under two minutes at the Town station, and then, with many whistlings, we steamed out at a walking pace along the cobbled street. So on to the quayside and into the Maritime station. As we drew up Inspector Baudry read his watch, and turned delighted to me with: "A temps"—dead on time.

Giant Rafts of the Pacific Ocean

Transporting Logs Across Stormy Seas

By Francis Dickie

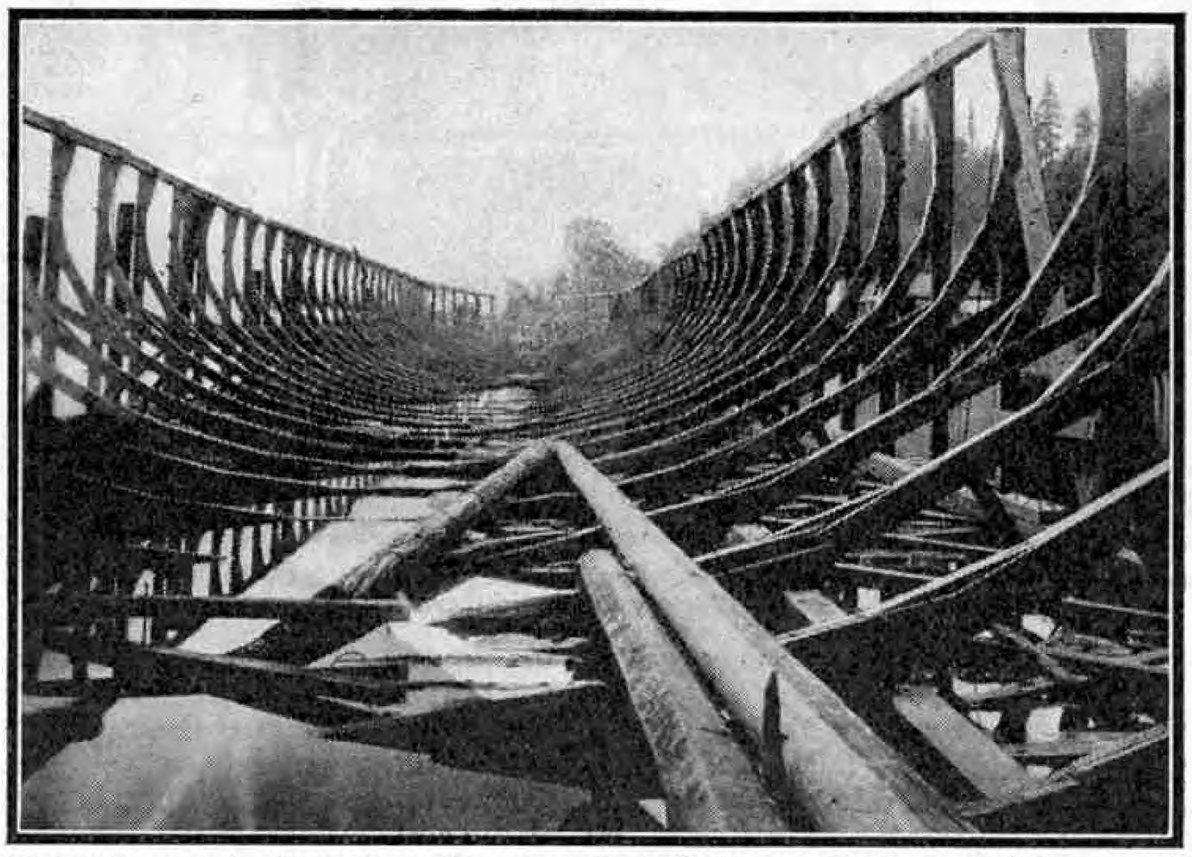
THE most remarkable sea-going structure in the world is the immense raft shown in the upper illustration on this page. It is built up of great logs from the forests in the Columbia River region of Oregon, and is towed 1,100 miles across the stormy Pacific Ocean to huge sawmills at Diago, in California, where it is converted into lumber. So far 105 of these rafts have made the long journey in safety, and many of them have carried deckloads of forest products, such as laths, fence posts and lumber, that otherwise would have required many steamships to transport them.



The Benson raft at sea. It contains thousands of logs, from 20 ft. to 100 ft. in length, lashed together by chains, and is built up in a giant cradle.

This sea monster has never been given a name. The men who created it speak of it among themselves as "the raft," and sometimes as "the Benson raft," but strictly speaking it is not a raft at all. To most people a raft is merely a few small logs, or even boards, fastened together, and in the log-towing business it usually means a single layer of logs held in a rectangular frame, the whole bound together by chains, with lighter logs laid crosswise on it. On the other hand the Benson raft is a carefully built-up structure that serves as a ship, yet at the end of its voyage every portion of it is a saleable article, or has been brought to a destination where it can be made into one.

In order to picture this huge craft, the reader must try to imagine thousands of logs, varying in length from 20 ft. to 100 ft., lashed together to make a structure 835 ft. long, 55 ft. wide and 28 ft. high. The whole is held together by three miles of chains weighing 175 tons, and a vivid idea of its size is given by the fact that its contents are sufficient to build a small town of about 250 wooden framed houses.



The huge cradle in which the raft is put together. The floating section on the left is removed when the raft is ready for launching.

The original idea of the raft occurred in 1885 to Captain H. R. Robertson, of St. John's, New Brunswick. Robertson worked out a scheme with J. A. Festabend, a man of constructional genius, and together they built the first sea-going monster. This was a very small one that ran into a bad storm and became a total loss when they tried to tow it from St. Johns to Boston, 287 miles away.

Eight years later Festabend went to the Pacific coast, and his belief in the importance of Robertson's idea was fired afresh when he saw the timber wealth of Oregon. There he met Simon Benson, a great lumber operator along the Columbia River, after whom the raft is now named. Benson was a member of a firm cutting logs in Oregon, but the best site for a mill to distribute lumber was San Diego, in Southern California, 1,100 miles away. Railway and steamer charges were too great to allow the logs to be carried there in the customary manner, and at that time nobody had ever dreamed of towing logs across the Pacific Ocean, on which stormy seas prevailed. To try it with the common type of log raft indeed would have been senseless, but Benson's scheme solved the problem.

Captain Robertson's idea was to make a cradle or berth in which logs and other material could be bound together. Benson and Festabend experimented on the Columbia River until they devised the cradle now used, which is fitted with an ingenious secret locking device. The cradle is of giant timbers, and in appearance suggests the skeleton of a vast prehistoric monster. It is built of detachable sections, with one side moored to piling and the other floating free. The logs to form the raft are towed alongside the cradle. Then a derrick on a floating platform is brought into position so that it can be run backward and forward along the full length of the cradle by means of a steel cable with its ends on the shores. Its arm lifts the assembled logs one by one and places each carefully in the cradle. Years of experience had taught the men who do this work just where each particular log length must go, and they literally weave these together, although the "threads" they use are solid timbers, often 100 ft. in length.

When half the raft has been laid down, loading stops until a chain 2½ in. thick has been laid along the entire length of the structure in order to form a backbone. To this chain lighter ones are shackled, to act as binding ribs, and these are run through the chains that encircle the raft and are attached to them. The next half of the raft is then put in place and the outer binding chains are drawn tight.

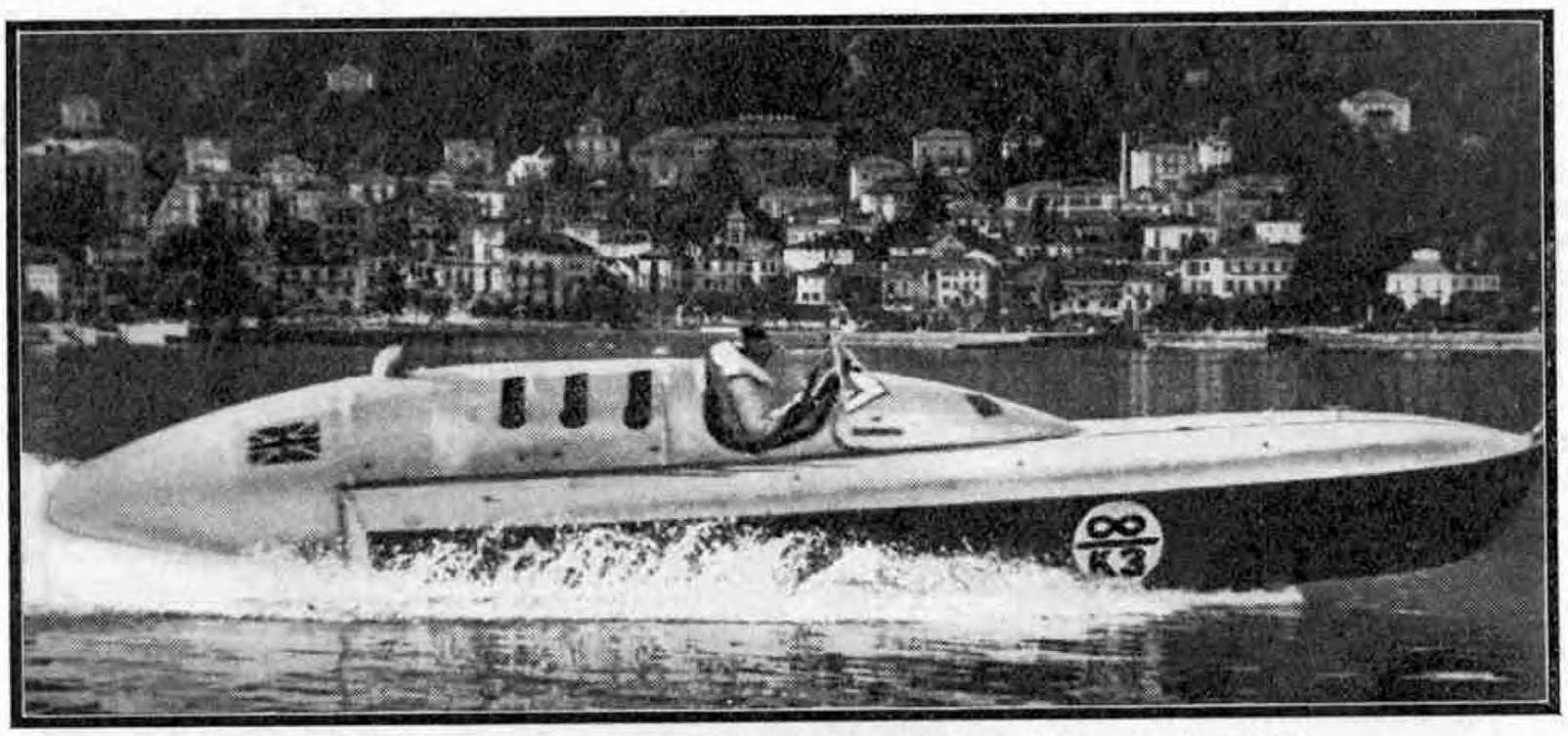
By the time the huge cigar-shaped bundle of logs has been completed, it has sunk deeply into the water. The detachable sections on the outer side are then removed, and the great bundle launched by "kicking" it clear of the other half of its berth by means of a machine-operated cable. The shape of the raft and the curvature of the fixed half of the cradle make this easy, in spite of the immense weight to be moved.

This modern wonder of combined cargo and carrier is then ready for its sea voyage of 1,100 miles. When in the water, its top flattens out a little, as it is designed to do, giving an enormous deck space on which the extra load of manufactured forest products can be lashed. Driving through the buffeting waves and the long ground swells of the Pacific, the monster reaches its destination in 15 days, covering more than 73 miles a day, an astonishingly good speed in view of its enormous bulk.

Sir Malcolm Campbell's Speedboat Record

"Bluebird's" Triumph on Lake Maggiore

ON Thursday, 2nd September, Sir Malcolm Campbell in his motor boat *"Bluebird"* attained a speed of 129.50 m.p.h. on Lake Maggiore, thus wresting the world water speed record from Commodore Gar Wood, the American who had held it for the previous five years. Sir Malcolm now has the distinction of having travelled faster than any other man on both land and water, for in his famous motor car, also named *"Bluebird,"* he covered a measured mile at an average speed of 301.13 m.p.h. on the Bonneville Salt Flats, in the United States, in 1935.



"Bluebird" at speed on Lake Maggiore, with Sir Malcolm Campbell at the wheel.

The struggle for supremacy between English and American motor boat enthusiasts has been very keen since the earliest recognised motor boat record was made by Mr. Gar Wood in March 1929. Sir Henry Segrave and Mr. Kaye Don, the well-known racing motorists, took part in it, but in 1932 Mr. Gar Wood regained the record from them with *"Miss America X,"* the largest and most powerful speedboat yet built. This vessel was 38 ft. long, with a beam of 10 ft. 6 in., and had four 12-cylinder Packard engines developing a total of 7,800 horse power. In her a speed of 124.86 m.p.h. was reached, and the American was the first to travel on water at the rate of two miles a minute.

This record remained unassailed until this year, when Sir Malcolm Campbell turned his attention to motor boating, and commissioned Mr. F. Cooper, M.I.N.A., to design for him a high-speed motor boat. This was built by Saunders-Roe Ltd., of East Cowes, and named *"Bluebird"* by Lady Campbell at her launch on Loch Lomond in June of this year. Her hull is 23 ft. long, with a beam of 9 ft. 6 in., and is finely proportioned. Double skin mahogany has been used for the planking, and a cigar-shaped metal cover extends from the steering cockpit to over 3 ft. beyond the stern. This cover and the deck are painted aluminium colour, and the hull is finished in the blue used on Sir Malcolm's racing car *"Bluebird."*

The engine fitted is of the Rolls-Royce 12-cylinder Schneider Trophy type, developing 2,350 m.p.h. at 3,200 r.p.m., and weighing 1,630 lb. It runs on a special "Ethyl" fuel that is carried in a 30-gallon tank on the port side amidships, and the engine at full speed consumes about 170 gallons an hour. The drive from the engine is taken forward to a gear-box, and then aft by a $1\frac{3}{8}$ in. shaft to the 12-in. two-bladed propeller, which makes about 9,000 r.p.m.

The design of the *"Bluebird"* departs from normal practice in having accommodation for only one helmsman. A further interesting feature is that she carries 240 gross of table tennis balls stowed under the foredeck, giving a buoyancy of one ton. The complete weight of *"Bluebird"* is $2\frac{1}{4}$ tons, so that the weight-power ratio is 2.14 lb. per h.p. This compares favourably with that of Mr. Kaye Don's boat, *"Miss Britain III,"* which was 2.3 lb. per h.p. and is considerably less than the 2.6 lb. per h.p. of *"Miss America X."*

Sir Malcolm commenced trials with *"Bluebird"* on Loch Lomond shortly after her launch. Weather conditions were, however, unfavourable, and no really high speeds were possible, so that Sir Malcolm had to abandon his efforts.

The Swiss Federation then made the suggestion that he should continue his speed attempts on Lake Maggiore. Accordingly *"Bluebird"* was taken to Locarno, on the shore of the lake, early in August. A $4\frac{1}{2}$-mile course was marked out between Mappo and Gerra, and a special slipway was built by local authorities to house the boat. A high speed was reached on the first official attempt on 21st August, but unfortunately the water cooling system broke down before the measured mile was completed, and the boat stopped. Rough surface conditions caused further attempts to be postponed for several days, although tests were made at speeds varying from 60 m.p.h. to 100 m.p.h.

Conditions improved sufficiently for two further runs to be made on 31st August, although there was still a strong wind blowing. On the following day, conditions were still more favourable and Sir Malcolm succeeded in beating Mr. Gar Wood's five-year old record of 124.86 m.p.h. *"Bluebird's"* average speed on the outward run was 125 m.p.h. and that on the homeward trip was 127.66 m.p.h., giving a mean speed of 126.325 m.p.h. This speed was reached in spite of the fact that the boat shipped water, apparently through broken intake pipes in the water cooling system.



Sir Malcolm Campbell.

Sir Malcolm was not satisfied, and within 24 hours he had surpassed his own record. This time the average for the two runs was 129.50 m.p.h., at which figure Sir Malcolm was satisfied to leave the record. In addition to the world motor boat speed record, Sir Malcolm gained that for single-engined boats, which was previously held by Mr. H. Scott-Paine, who drove his *"Miss Britain III"* at a speed of 110.11 m.p.h. at Genoa in 1934. This vessel was fitted with a 1,375-h.p. Napier engine.

The two record runs were made with the second of two Rolls-Royce engines that Sir Malcolm had taken with him from England. The first had been damaged in an early run. *"Bluebird"* required about a mile in which to attain full speed, so that the course marked out gave an ample margin on each side of the measured mile. Sir Malcolm found the boat much harder to steer at her maximum speed of 130 m.p.h. than his car *"Bluebird"* when running at 300 m.p.h.

Sir Malcolm is not expected to try to improve upon his record this year, but he is confident that *"Bluebird"* is capable of setting up new figures if certain modifications are made.

There is still much to be learned about the behaviour of motor boats at high speed. Sir Malcolm and the designers and builders of *"Bluebird"* and her engines carried out many experiments with new designs when preparing for his record attempts, and in doing so obtained information of great value in boat and engine building.

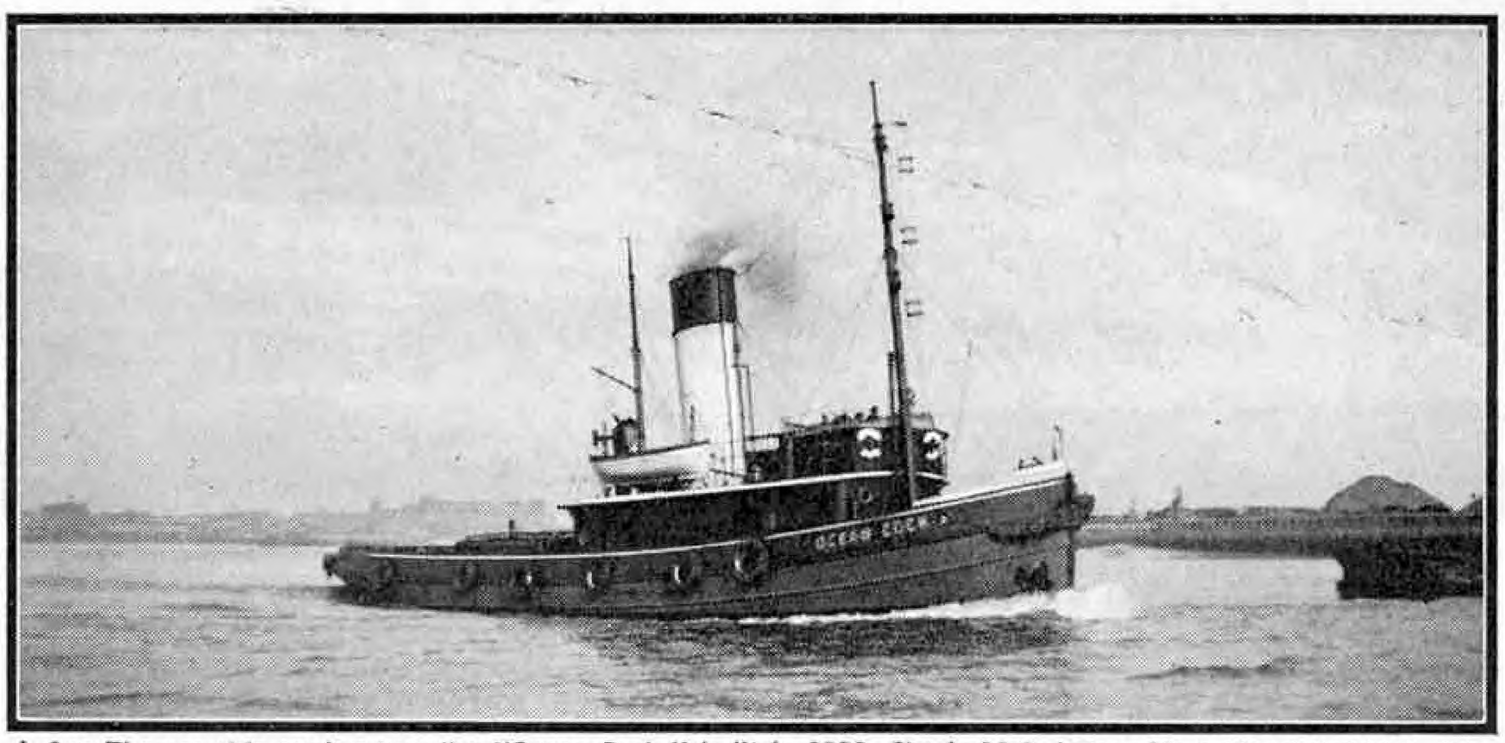
Tugs of London River

The Everyday Work of a Fine Fleet

By W. Philip Conolly

ON the Thames to-day some 350 tugs, steam, motor and Diesel-electric powered, find work, mainly in ship-towing and lighterage activities. When one compares the London tug, the ship-towing type particularly, with those of some other ports, its relative smallness becomes apparent; there is, for instance, no vessel approaching in size some of the tugs working at Liverpool or Southampton. Even the largest tug on the Thames is little more than half the size of many tugs elsewhere.

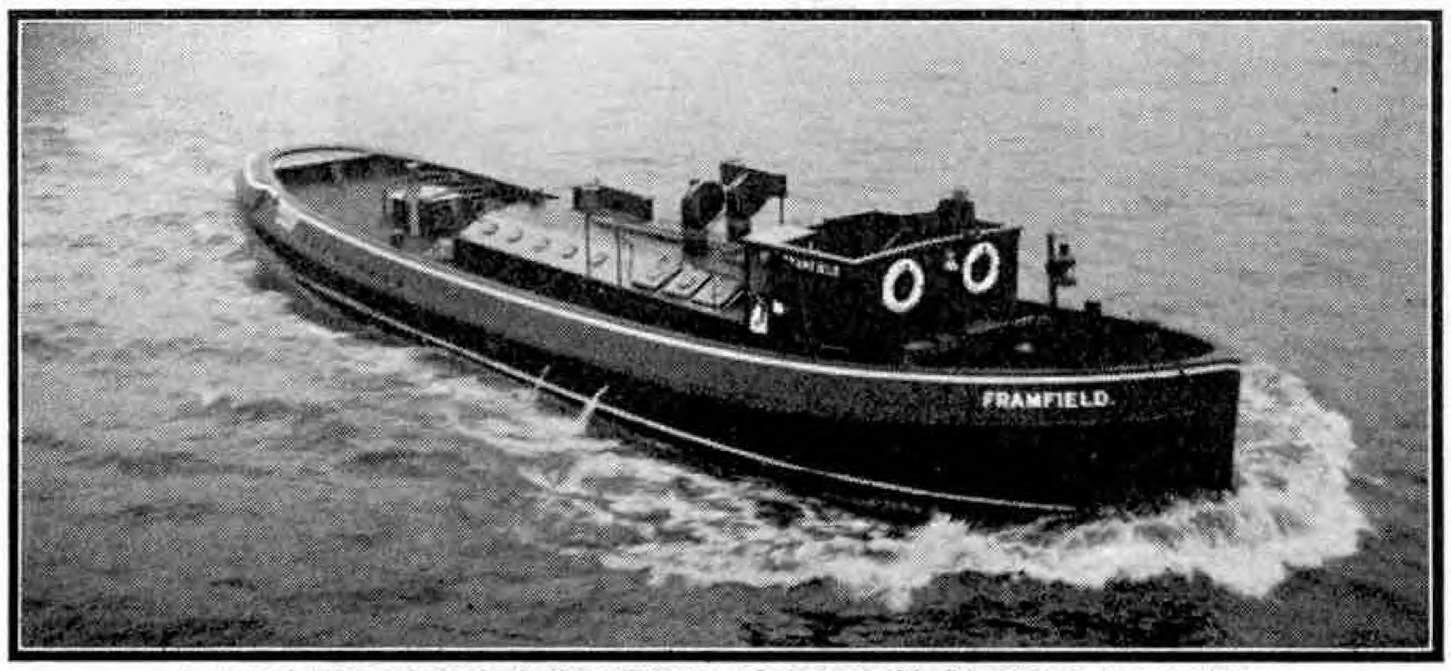
This is the *"Danube IV,"* of 239 gross tons, used not for ship work but for towing mud-hopper barges to sea, where the material they contain, taken from the river bed by the dredgers, is deposited on the sea floor. Such vessels as the *"Romney,"* 509 tons gross, reputed to be Britain's largest tug, are mostly employed at the trans-atlantic liner ports, where ships up to the size of the *"Queen Mary"* must be handled. The use of the bigger tug is obviously uneconomical when the largest ships regularly using London's docks are the 28,000-ton Cunard White Star liners *"Britannic"* and *"Georgic."*



A fine Thames ship-towing tug, the "Ocean Cock," built in 1932. She is 96 ft. long, with a draught of 11 ft. 8 in.

The earliest steamer believed to have been employed as a tug was a Thames vessel. She was the *"Majestic,"* and was launched in 1816. On 28th August in that year she towed two sailing ships named *"Hope"* and *"Indiaman"* respectively from Deptford to Woolwich, at a speed of 3 m.p.h., this low figure probably being due in part to the head wind she encountered.

It was not until about 50 years later that a real demand for tugs arose, however, and steamers specially strengthened to withstand the strain of towing ships much larger than themselves began to be built in increasing numbers. The tugs employed were wooden-built steamers, and although fairly steady in rough weather they were uneconomical to work, as they consumed excessive quantities of fuel. It was therefore usual for the tugs to carry a limited amount of sail, and this was relied upon when the vessel was not actually engaged in towing, so as to save as much coal as possible.



A tug without a funnel. A good example of a type with Diesel-electric propulsion.

Tugs soon began to steam out as far as the Downs, and even farther, in search of inward-bound sailing ships willing to pay the cost of towage to London rather than wait for a favourable wind. They were encouraged to do this by the increasing competition between steamships and sailing ships, which made it essential for the latter to avoid being delayed perhaps many days by adverse winds or calm. The tug skippers had to take care that they did not go so far out to sea that they ran short of coal on the way back.

This practice of seeking a tow in the waters outside the Port of London began to diminish with the decline of the sailing ship, and is now a thing of the past. When any of the few surviving sailing ships are inward-bound they invariably call at some western port for orders on reaching English waters, and if they have to discharge their cargoes in London arrangements are made for a tug to meet them in the Downs.

The earliest tugs were paddle-wheelers, but those of to-day are powerful screw-propelled vessels. The present-day trend in new construction is to instal the internal combustion engine, and about one-sixth of the tugs on the Thames are of the motor variety. Only a very few steam tugs have been built for London during the past year or so—one or two for ship-towing, and less than half-a-dozen for lighterage work. In fact several steam tugs have been converted to motor vessels.

Several years ago a new form of motive power for tugs was introduced, the Diesel-electric. The first vessel of this type was put in service in the United States, and the first in Britain, the *"Acklam Cross,"* began work on the Tees, towing ships. No motor tugs, Diesel or Diesel-electric, have yet been used on London River for ship work, however, all such work still being done by the steam tugs. There are several Diesel-electric tugs used for lighterage. Paddle tugs, which still survive here and there in the more shallow ports, have all disappeared from London towing.

The tug is a specialised vessel with an anatomy like that of no other ship, and her lines, which are the outcome of long experience, have been found the most suitable for the type of work she has to do. The hull, which is of very substantial construction, has a length, in harbour tugs, of from 90 ft. to about 110 ft. Equivalent figures for "craft" or lighterage tugs are from 30 ft. to 85 ft. Breadth measurement is usually a fourth or a fifth of the length. A deep draught is essential, the stern, which is deepest in the water, having a pronounced counter or overhang to give the propeller blades adequate protection. Plenty of breadth and depth give the tug great stability and help in preventing her from capsising in the event of the tow taking command. The tug in effect has an abnormally low centre of gravity. The deeper draughted after-end, where the tow-rope is made fast, ensures that the tug is only pulled bodily sideways through the water, instead of being turned over when the strain comes on the tow-rope from abeam. The fact that the propeller is nearly always immersed in water, having a good "grip" except under the worst sea conditions, prevents the engines from racing, with a consequent loss of "way" on tug and tow. A tug has most freeboard at the head, having a good sheer, which helps to keep her dry in high seas.

The tug's sides above the rubbing band, the bulwarks, assume an inward slope, a construction termed "tumble home." When the tug

heels over under stress the tow-rope can lay flat on the bulwarks without pulling a section out, as would possibly happen if they were built vertically. The rubbing band and the suspended fenders —the latter sometimes old motor tyre cases—correspond to the buffers of the railway locomotive in that they absorb the shocks when craft are manœuvred and berthed.

Special deck features include the towing hook and arches, the hook sometimes running on a horizontal semicircular plate, the hook table. Often a catch is provided in the hook, and the rope can be "tripped" off in an emergency. The towing arches, a prominent and characteristic feature in tugs, give protection to various deck fittings, preventing the tow-rope from carrying them away as it swings out of the fore-and-aft line when the tug turns in relation to her tow. "Dollies" or short posts fitted forward, aft and on each side, are used for mooring and when manœuvring craft.

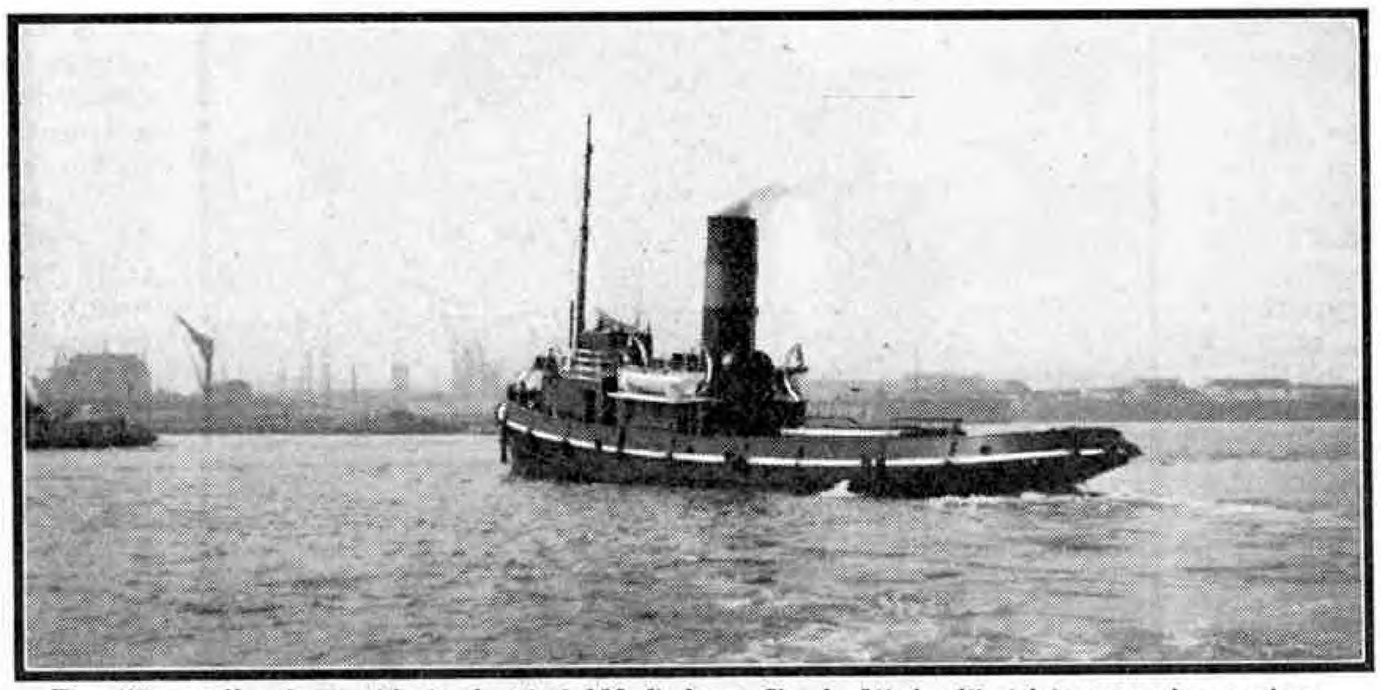


The "W.R. Cunis," a medium size lighterage tug at work.

The lighterage or "craft" tug—sailing barges, lighters, etc., are called "craft" on London River—finds much work "above bridges," and tugs working "up through" to Brentford or Kingston must have some arrangement for lowering masts and funnels. The funnel, situated behind the wheel-box, with the "fiddley" gratings, which give access to the stokehold, in its rear, is pulled down by means of a rope and pulley. The movable part works on a spindle fitted in the base, which is mounted on the boiler room casing. Balance weights help in restoring the funnel to its normal position. The mast consists of three parts, the topmost section being so arranged that it assumes a vertical position when the centre part is lowered to the horizontal and in this position the headlights, oil or electric, can be seen at night.

Headlights are white; one is carried when the tug is running light, and two, one above the other, are used while towing. If two bow tugs are working on a ship, one tows on a longer rope to keep clear of its colleague, and this one carries three lights vertically arranged. The side lights, red for port and green for starboard, are the same as on all other vessels. When electric lamps are used provision must be made for their possible failure, and spare oil sets are carried. The tugs engaged in petrol lighter towage have an extra fitting, a metal "flag" painted red with a white central disc. This informs other river users of the nature of the tow.

Space below deck is somewhat restricted, and boilers, engines, condensers, bunkers, etc., must be very compactly arranged. In steam propulsion compound two-cylinder or triple-expansion three-cylinder engines are used. The salvage and ship-towing tugs carry powerful pumps for fire-fighting, and for clearing stranded ships' holds of water. Hose is provided also for the supply of steam to ships when their boiler fires are out and auxiliary machinery must be worked. The motor tug with its Diesel engine usually has more room below deck, as the only other space requirement is oil fuel bunkerage.



The "Tanga," a large ship-towing tug 100 ft. long. She is fitted with triple-expansion engines.

The Diesel-electric tug usually has two motors arranged side by side. These each drive an electric generator that supplies current to the propulsion motor driving the propeller. Although an engineer is carried, these tugs can be fully controlled from the wheel-box by the skipper.

The ship-towing tugs have most of their work allotted to them under towing contracts and, except when salvage is undertaken, their duties are all well defined. All the large shipping companies have regular tug attendance, and gone are the days when tugs went to sea "seeking" as far down Channel as the Scillies. Some spent days at sea in the hope of picking up a profitable tow in the shape of the then numerous sailing ships bound for the Thames. Good money was made, especially when, for instance, a tea-clipper, hurrying for the London market, was taken on the tow rope. Most of the work then was of a very haphazard nature, and when tug and ship made contact the two skippers would, if time was not too precious, bargain for the best price according to their respective points of view.

The uncertain jobs are of course salvage, and each tug skipper is alert to be on the scene as early as possible. Work is usually undertaken on Lloyd's Standard Salvage Agreement—no cure no pay. Much work concerns stranding, but it is extremely rare for tugs to pull a ship off the ground as a dead weight. The ship is first lightened, her cargo, bunkers, and sometimes ballast being disposed of when on a spring tide she comes free with the tug's help. Not all shipmasters will take the services of a tug, however, and if they are in a fairly good situation with a high tide to follow they may try to get off under their own power.

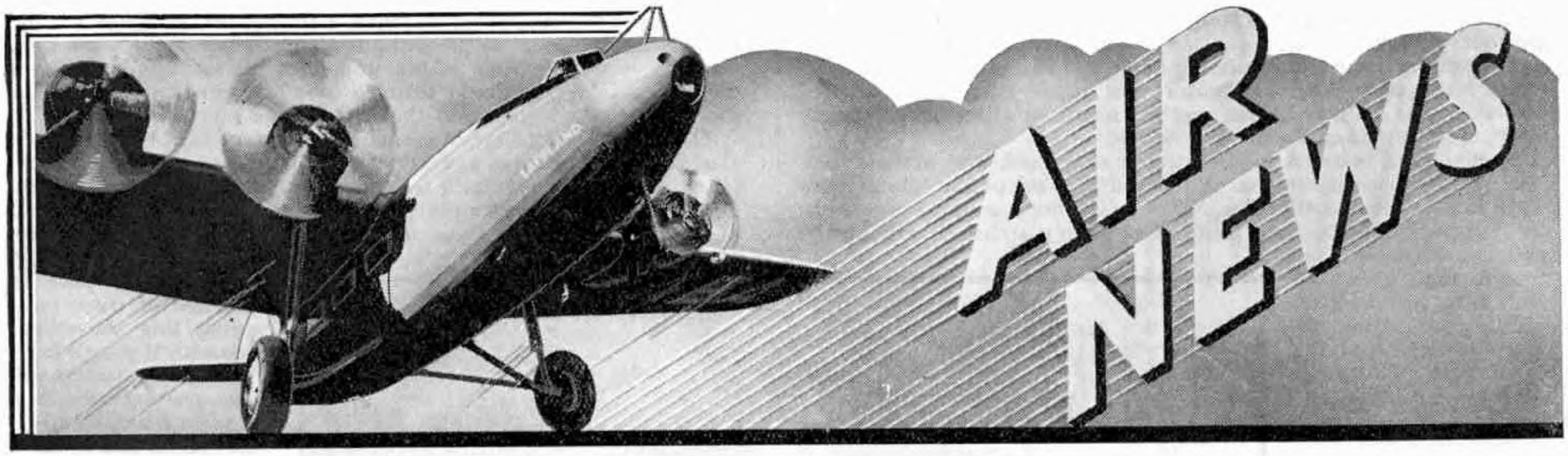
Two London tugs found themselves off their regular beats recently when they went to Dartmouth to tow a ship, which had been ashore, to Southampton. This vessel, the *"English Trader,"* became fast on the rocks at the entrance to Dartmouth Harbour. As she could not be released, divers descended her hold to build a wooden bulkhead near the bows. The ship's forepart was then cut away and left on the rocks. The remaining seven-eighths of the ship was towed the 147 miles to destination stern first.

The lighterage tugs towing the internal trade of the river are its goods locomotives, and many kinds of commodities are towed in lighters, from household refuse going to the huge dumps at Rainham, to motor cars coming into the docks as imports from abroad, notably America. Lighterage work falls into two chief categories, "quay work" and the "rough goods trade." The first concerns the conveyance of all the finer quality goods, cased goods, wheat, bonded goods from the Customs, etc. All such work requires constant attendance by a lighterman while it is in the barge, and most of it is carried under hatches. The second class deals with such items as coal, sand and ballast, timber, any anything of a not specially valuable nature.

Petrol towage is subjected to restrictions not experienced by other freights. It must not be towed after dark, or in fog, and heavy penalties are inflicted for infringement of these rules. The nearest mooring—and there are several emergency buoys in various parts of the river—must be sought when conditions become unfavourable. The petrol, which comes from the great oil depots in the Thames estuary, is towed in large tank lighters, the maximum number towed per tug being four. Other classes of freight allow a maximum of six lighters per tug.

A more unusual job for these tugs occurs when a bridge is rebuilt and one is stationed at the works for towing any unpowered craft, sailing barges, lighters, etc., through the bridge workings, so that they shall not cause damage by possible collision with piling construction. One tug, the *"Mosquito,"* has been on somewhat similar work for 40 years at Tower Bridge, taking up her duties from the time the erection of the bridge was completed in 1897. Her job is to keep the fairway clear below the moving bascules, maintaining uninterrupted service for both the river and the roadway above.

Little out of the ordinary befalls the river tug, but a year or two ago an unusual job fell to the tug *"Regent"* at Hammersmith. A Dutch motor freighter became wedged below Hammersmith Bridge owing to the deck of this bridge having a very low clearance at high water. The crew jumped overboard, "abandoning ship," and when *"Regent"* had picked them up she towed the ship from under the bridge deck, the ship losing several plates as a result of this encounter.

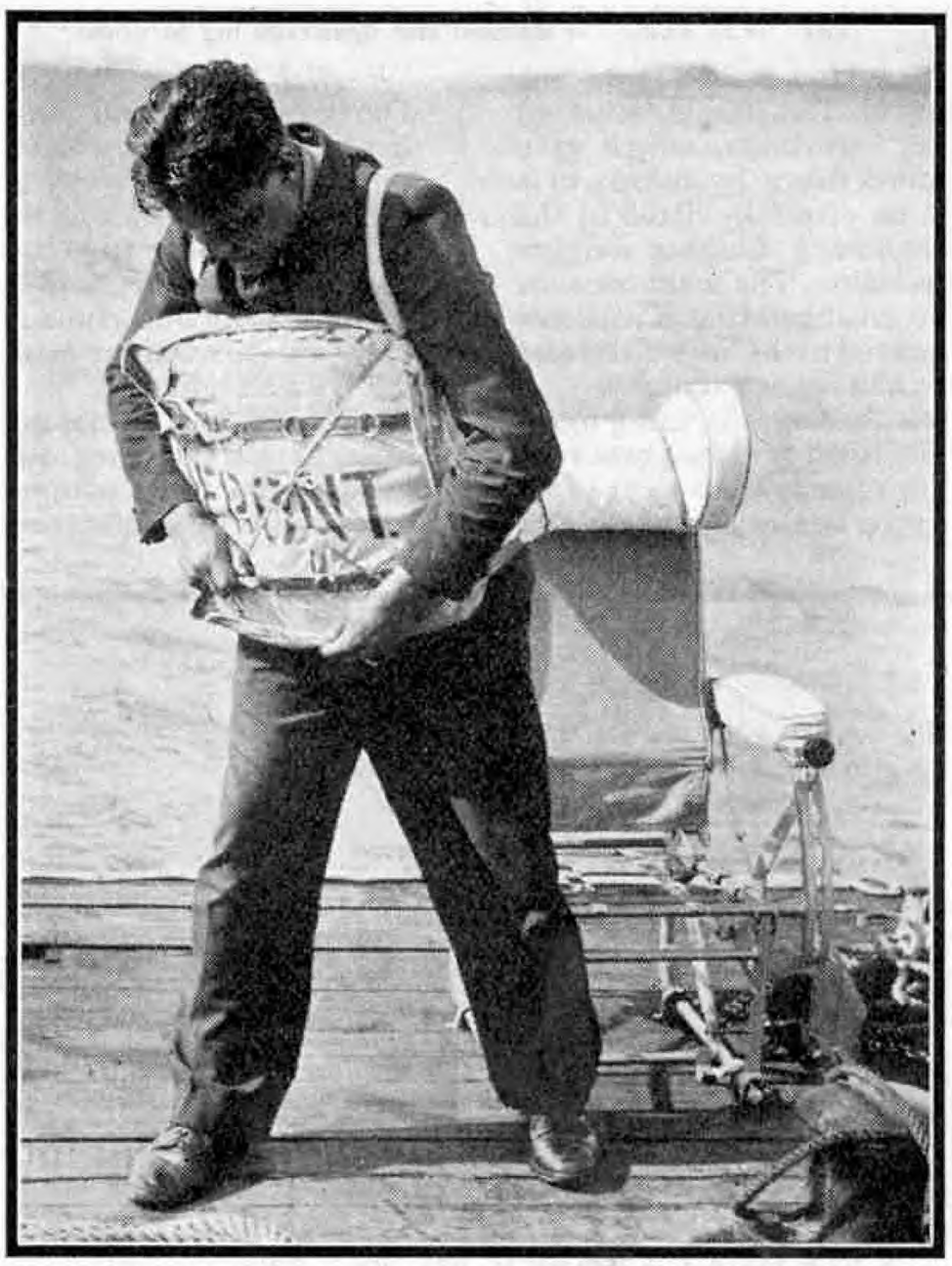


"Safety-Seats" in Empire Flying Boats

A flying boat on the water is open to the same mishaps as a steamship, and aircraft of this type engaged in passenger traffic have to carry efficient life-saving equipment. The Imperial Airways flying boats now operating on some of the Empire air routes carry up to 24 passengers and a crew of five. Ordinary life-belts are too bulky and too heavy to be carried conveniently in respect of so many persons. Imperial Airways experts have therefore had to develop life-saving equipment of the requisite lightness, and after 18 months' research they have designed a new pattern "safety-seat" which they claim is unequalled for simplicity, lightness and efficiency.

In this device the seat cushion and the back cushion serve the dual purpose of providing both comfortable upholstery and a concealed but easily accessible life-belt. The two cushions are of rubber, and have been made on the "float-on-air" principle to a secret specification by David Moseley and Sons Ltd., whose research experts working on the production of ultra-light weight rubber helped to perfect the new safety-seat. The total weight of the two cushion covers and straps is under 5 lb. The cushions can be converted into a life-belt within 10 sec., and in that form can support indefinitely in the water two men of a total weight of 20 stone.

The illustration on this page shows the safety-seat being fitted as a life-belt. In spite of the lightness of the device, the cushions are very comfortable during travel by air, and "roll" or undue sag have been eliminated by a process of manufacture in which each cushion is built up of four separate compartments.



Demonstrating how the patent "safety-seat" fitted in the Empire flying boats can be used as a life-belt. Photograph reproduced by courtesy of David Moseley and Sons Ltd., Manchester 12.

The Tale of a Tooth

The efficiency of radio communication between air liners in flight and ground stations was proved recently in rather an unusual fashion. A passenger on board an Imperial Airways Empire aircraft suddenly developed a painful toothache, and as he was not likely to gain much relief until the offending tooth had been removed a radio call for a dentist was flashed to the next point at which the air liner would halt. When the aeroplane landed there a dentist was waiting to make an immediate extraction. By the time the aeroplane had put down and taken aboard its loads, and refuelling operations were completed, the passenger had been relieved of the painful tooth, and was ready to continue the journey in comfort.

Autogiros for R.A.F.

Little has been heard lately of the "direct lift" Autogiro perfected by the late Senor de la Cierva, but the news that five of these machines have been ordered by the Air Ministry may lead to greater public notice being taken of this interesting type of aircraft. The British Aircraft Manufacturing Co. Ltd., of Hanworth, are co-operating with the Cierva Autogiro Company on this contract, and are building the fuselages, which will be of wood and of polygonal cross-section. A Salmson 9-cylinder engine of 203 h.p. will be fitted in each machine. The crew of two will occupy side-by-side seats in an enclosed cockpit, whereas in the original "direct-lift" Autogiro from which the new machine has been developed, there are two separate and open cockpits arranged in tandem.

The five Autogiros will be thoroughly tried out by the R.A.F. under Service conditions, and the announcement of the verdict of the Air Ministry will be awaited with interest.

R.A.F. Vacancies for Apprentice Clerks

The Air Ministry announce that further vacancies under the Apprentice Clerk Scheme will occur in the R.A.F. this month. This scheme offers excellent opportunities for a Service career to boys from Secondary, Central, Junior Technical and other schools who have no inclination towards a mechanical trade, but are attracted to Service life and wish to travel abroad. Candidates must be between 13½ and 17¼ years of age on 1st October, and they must possess either an approved School Certificate or evidence that they have attained an approximately equivalent educational standard.

Successful candidates undergo a thorough course of training in clerical duties during their first 18 months' service. During that time special attention is given to their general education and to physical training. The work on which Service clerks are employed in offices at Headquarters of commands and other formations at home and abroad is varied, and covers administrative work in the case of clerks (General Duties), and accounting for pay and equipment in the case of other clerks.

Apprentice Clerks are attested for 12 years regular Air Force service from the age of 18 years. A limited number will be permitted to re-engage to complete 24 years' service and so qualify for an R.A.F. pension. Those who return to civil life after completing 12 years' service will be given an opportunity of entering the R.A.F. Reserve and of drawing a gratuity of £100.

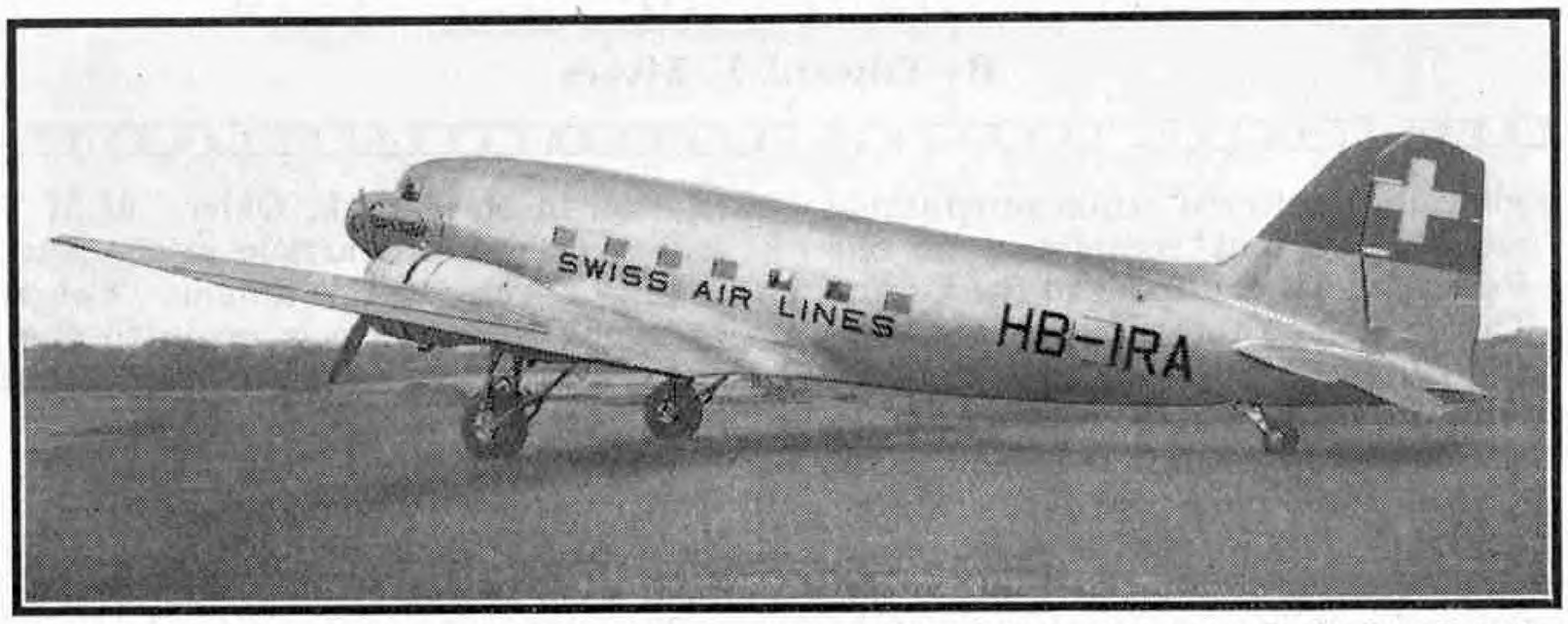
It should be mentioned that all Apprentice Clerks have an opportunity to volunteer for training as airman pilots, and those who are selected become sergeant pilots and are employed on flying duties for six years. Airman pilots who are specially qualified may be recommended for permanent commissions in the General Duties branch, and a limited number of permanent commissions may also be granted in the Accountant or Equipment Branches to ex-apprentice clerks.

Full information concerning rates of pay, promotion, etc., is given in A.M. Pamphlet 9, a copy of which may be had upon application from the Air Ministry, Boys' Department, Victory House, Kingsway, London, W.C.2.

The next date after this month when there will be R.A.F. vacancies under the Apprentice Clerk scheme is January 1938.

More British Atlantic Flights

The times taken for the first crossings of the Atlantic by Imperial Airways' flying boats *"Caledonia"* and *"Cambria"* have been considerably improved upon during subsequent flights. On the 21st August last the *"Caledonia"* accomplished a return flight from Botwood to Foynes, a distance of 1,993 miles, in the record time of 11 hr. 33 min., at an average speed of 173 m.p.h. At the time of writing the fastest westward flight has been made by the *"Cambria,"* which on 27th August crossed from Foynes to Botwood in 14 hr. 24 min.



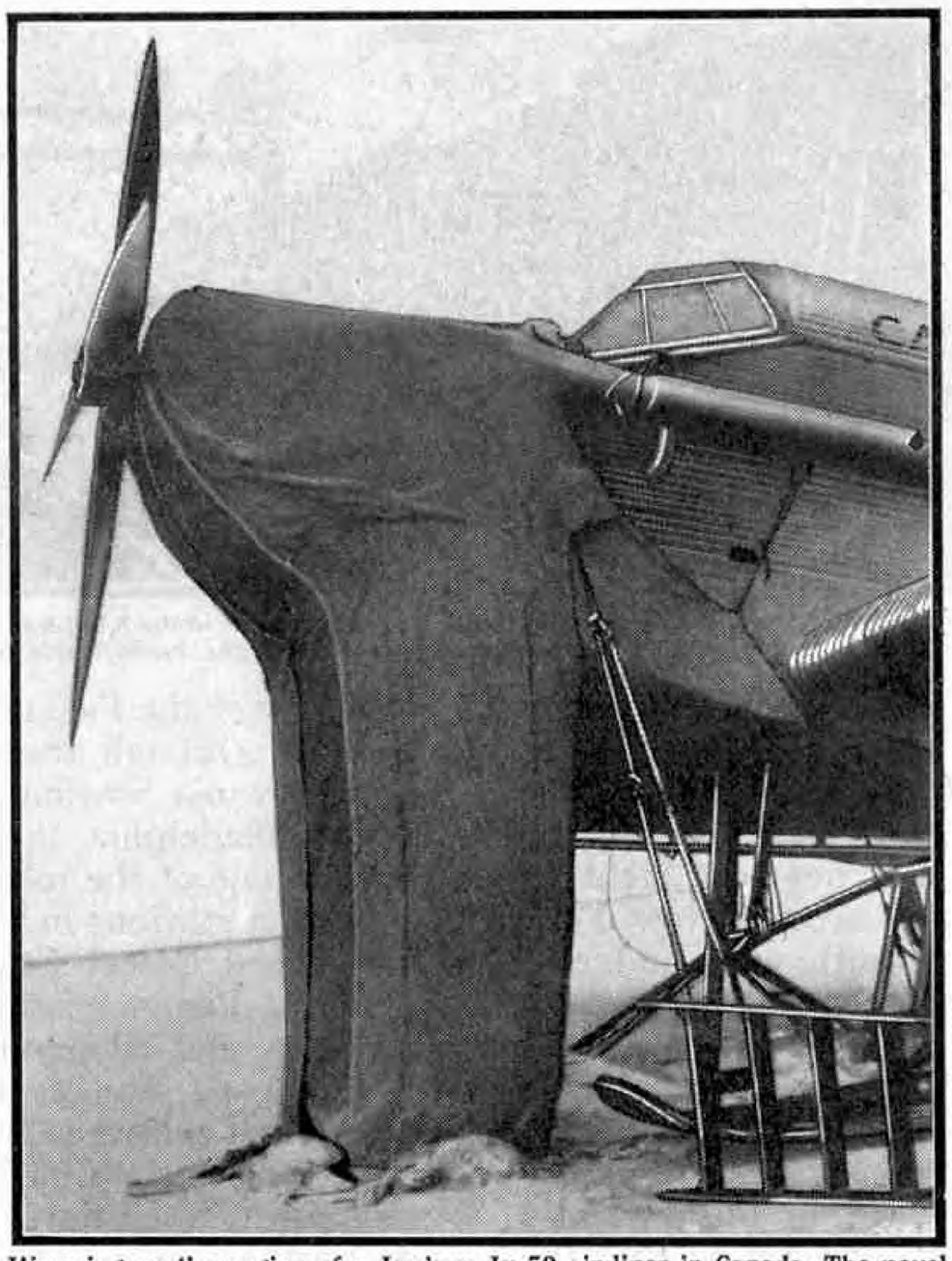
The first Douglas D.C.3 air liner acquired by Swissair, the well-known Swiss air transport company, about to leave Rotterdam Airport for Zurich. Photograph by courtesy of N.V. Nederlandsche Vliegtuigenfabriek, Amsterdam.

The precision with which these two flying boats have maintained their courses across the North Atlantic with complete accuracy by night and day has drawn attention to the means by which such long-distance air navigation is now accomplished. A vital part is played by radio, and the pilot can ascertain the position of his aircraft at any time during a flight by tuning in to ships and to shore radio stations, and working out bearings from the signals received.

Regular use is also made of drift and speed indicators, but these instruments are only effective while the navigator is able to see the surface of the sea or land over which the aircraft is flying. When the flying boat is obliged to fly above cloud, and the waves of the ocean are difficult to see, or when no ground landmarks are visible, nautical or astronomical navigation is employed. This entails observations of Sun, Moon or stars by means of sextants designed specially for aircraft use, and the position of the aircraft is calculated from these astronomical observations by the aid of nautical tables.

New Helicopter Breaks Records

A new helicopter at present called the "F.W.61" has been built in Germany, and during a recent trial flight from Bremen aerodrome it reached a height of 8,125 ft., which is a record for this type of machine. The helicopter attained a speed of about 76 m.p.h., compared with the previous record of about 27 m.p.h. It has two three-bladed horizontal propellers, one on each wing, which are driven through shafts by a 160 h.p. engine. When the machine has attained flying speed the blades act like those of an autogiro.



Warming-up the engine of a Junkers Ju 52 air liner in Canada. The novel method employed is described in the special article on page 576. Photograph by courtesy of Junkers Flugzeug- und -Motorenwerke A.G., Dessau.

German Machines Cross the Atlantic

Other countries in addition to Great Britain, Canada, and the United States are actively interested in establishing regular air services across the North Atlantic. France is busy preparing a giant flying boat with which to carry out experimental ocean flights, and Germany has already carried out one series of such flights, employing seaplanes launched from catapult ships for the ocean crossing.

A second series of German test flights was begun on 11th August when the seaplane *"Nordmeer"* took off from Lubeck, and flew in easy stages to Port Washington, Long Island, New York, by way of Portugal and the Azores. The long journey of 2,392 miles from the Azores to New York was accomplished in 16 hr. 27 min. The *"Nordmeer"* remained at Port Washington until the arrival of the catapult ship that had launched it at Horta, in the Azores, so that it could be similarly launched for the long return ocean flight. In the meantime a sister aircraft, the *"Nordwind,"* had left Germany, and followed the same route as the first seaplane, being launched at Horta by another catapult ship.

The *"Nordmeer"* and *"Nordwind"* are powerful seaplanes built by Bloehm and Voss, the famous Hamburg firm of shipbuilders, specially for these experimental flights. Each seaplane is fitted with four Junkers "Jumo" Diesel engines.

Success of New Bristol "Mercury" Engine

The new medium supercharged Bristol "Mercury XI" aero engine has satisfactorily completed both its official type tests and a 200 hrs. flight endurance test. This engine is of the air-cooled radial type, and develops the high maximum output of 890 b.h.p. at 6,000 ft.

The flight test was carried out in a Hawker "Hart" single-seater fighter, which was fitted with a Bristol constant-speed controllable-pitch airscrew for about half the flying period. The combination of this airscrew with the "Mercury XI" engine gave a most impressive take-off and climb, the take-off run usually being less than five seconds. The test was scheduled to cover very severe conditions of Service flying, and included a large number of all-out level speed tests, with climbs to about 28,000 ft., during which air temperatures as low as 36°C. were encountered. The engine gave a consistently good performance throughout, and it was in exceptionally good condition when it was dismantled afterwards for examination. All highly stressed components were reported to be quite free from defects, and special comment was made on the excellent condition of the pistons, piston rings and cylinder bores.

The Trans-Canada Air Mail

The Canadian Minister of Transport recently completed an official survey flight of about 3,000 miles over the proposed Canadian transcontinental air mail route between the Atlantic and the Pacific coasts. He took off from Montreal and flew by stages to Winnipeg, and thence to Vancouver. The aeroplane used was an "Electra," one of the Lockheed types that will be employed on this air route by Trans-Canada Air Lines. The huge task of completing the ground organisation of this great airway, and particularly the radio and meteorological services, is well in hand, and it is hoped to have the whole route in operation early next year.

United States to Speed Up Air Mail Delivery

The U.S. Government are to spend £20,000 on four series of experiments designed to speed up air mail delivery. One series of experiments will consist of coast to coast trips by high-speed aircraft. Another will be concerned with experimental air mail pick-up devices, and the third with the establishment of "air ferries" in suitable localities. The fourth series of experiments may be the most interesting, for in them efforts will be made to effect quicker transport of air mail between airports and chief post offices by employing gyroplanes, and Chicago and Philadelphia post offices have been selected as suitable termini. A gyroplane can descend vertically, like an autogiro.

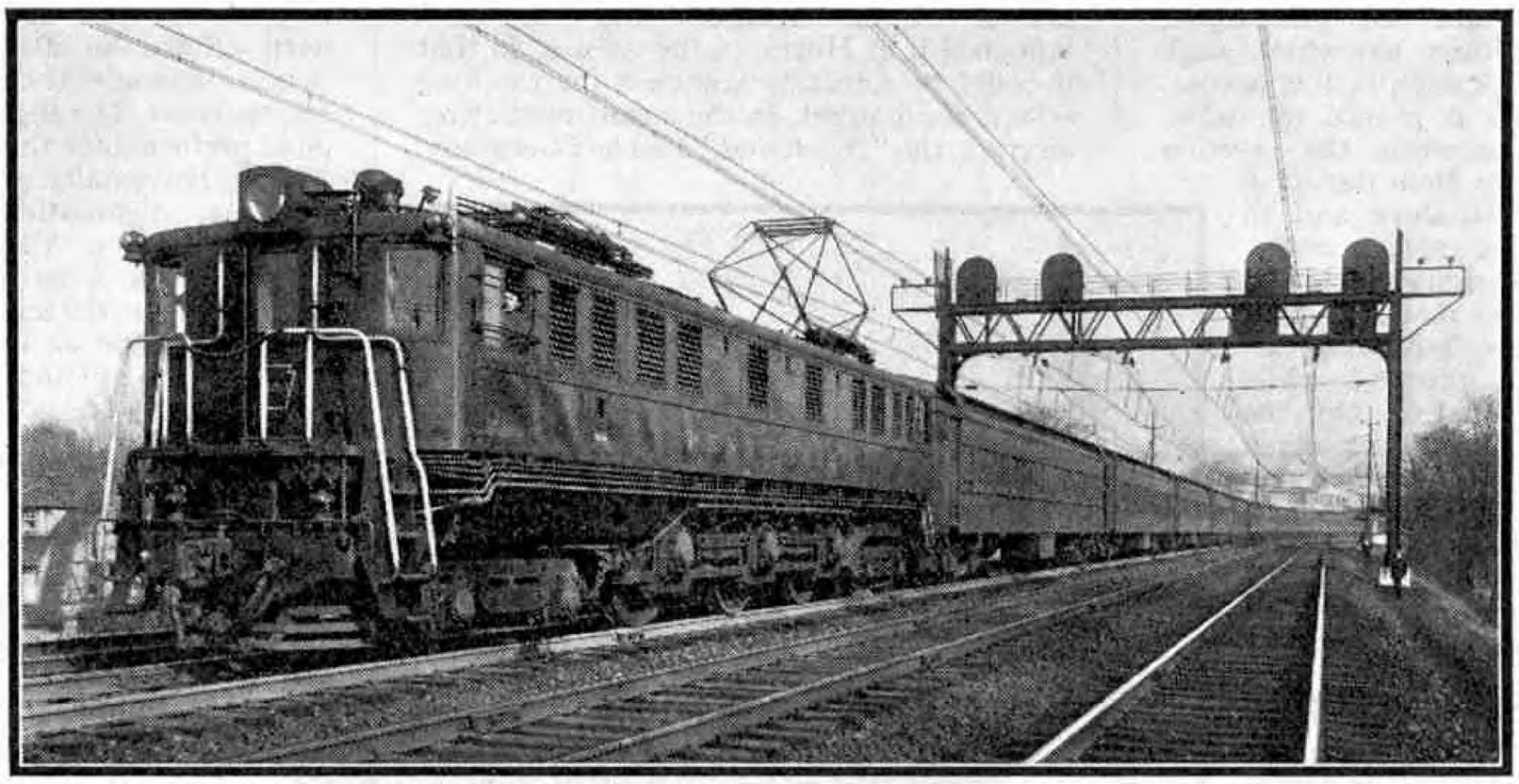
Electrifying the Pennsylvania Railroad

A Notable Main Line Conversion

By Edward T. Myers

THE greatest single railway electrification programme that has yet been carried out completely at one time is that of the Pennsylvania Railroad, in the United States of America. This includes a total of approximately 310 route miles and 1,030 track miles, and has involved the main line of the Company from New York to Washington, together with those branch lines and yards along this stretch that were not already operated electrically.

The reason for this great programme of main line electrification was the desire to improve both the freight and the passenger services of the railway. With steam operation the tracks between New York and Washington, a distance of 224.8 miles, were being used practically to capacity in the operation of long-distance traffic. Since the electrification was inaugurated, the accelerations and general improvements that have been made to the through services have had the effect of making this section probably the busiest high speed main line in the world.



An express on the electrified main line of the Pennsylvania Railroad, hauled by one of the 3,750 h.p. locomotives of class P-5. The illustrations to this article are reproduced by courtesy of the Pennsylvania Railroad.

The scheme for electrification was decided upon some years ago. Studies were made that covered not only the generally known advantages of electric traction, but also the whole industrial and transportation situation in the United States. The probability was not lost sight of that by 1950 the metropolitan area around New York would extend considerably farther both west and east than at present, and that it would contain perhaps 30 million people.

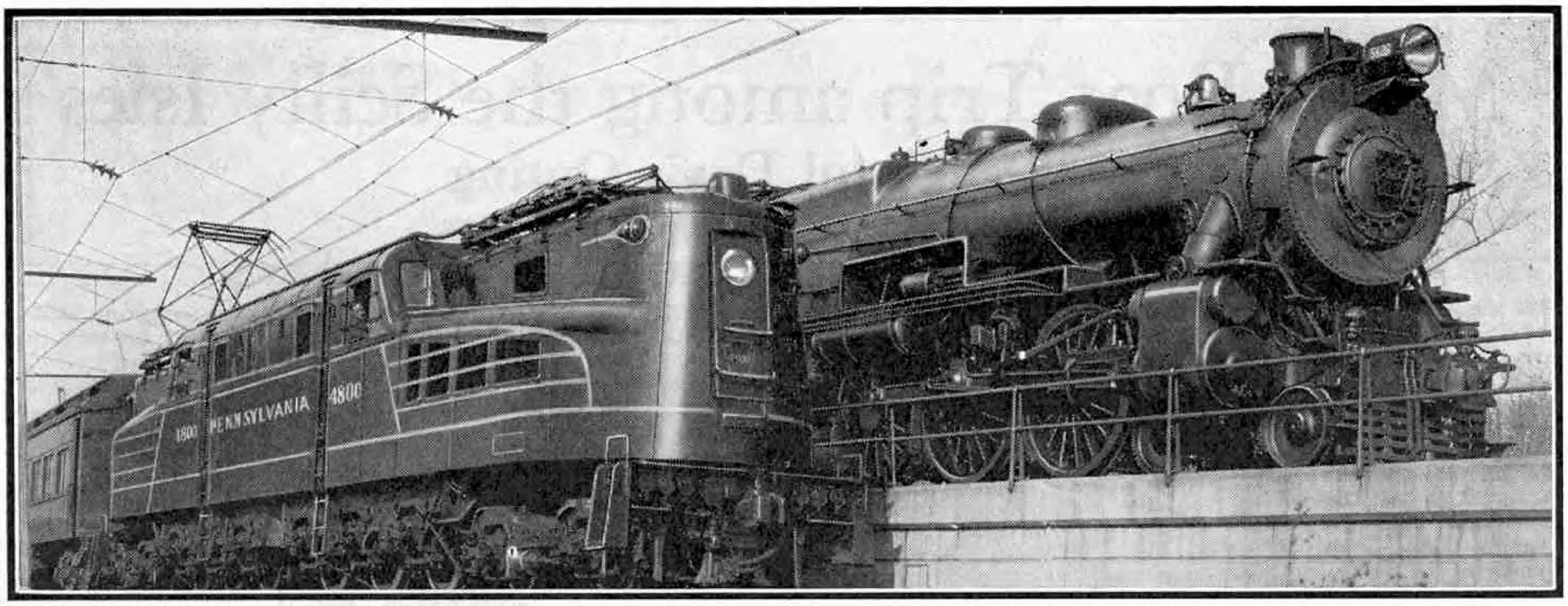
In 1928, the company planned to make the change slowly, but early in 1931, the late General W. W. Atterbury, then President of the Pennsylvania Railroad, in the face of the growing depression in business and the increasing need for employment, announced that the programme would be speeded up. General Atterbury pointed out that prices were at such a level that the improvements could be contracted for at exceptionally favourable rates. He argued that at a time of reduced traffic the work could proceed with much less interference from the movement of passing trains.

For many years electric locomotives have pulled Pennsylvania trains through the tunnels under the Hudson River into the magnificent Pennsylvania Station in New York. Older "*M.M.*" readers no doubt will remember the article in the August 1928 issue describing a run on the famous "*Congressional Limited*," in which reference was made to the change-over from steam to electric locomotives at "Manhattan Transfer," New Jersey. Passengers on trains from the west who wished to go to what is known as "downtown" New York, instead of continuing to the main station, also have in the past changed at Manhattan Transfer, in their case to the Hudson and Manhattan Railroad.

The change from steam to electric power is now made much farther west, so that there is no longer need for a stop for this purpose at Manhattan Transfer before entering the tubes under the Hudson River. Passengers for the Hudson and Manhattan line now transfer at a new and architecturally splendid structure in Newark, New Jersey. This new station is the terminus of a new city underground railroad, or "subway," and provides facilities for buses, taxicabs, and private cars. Included with the station improvements at Newark is a bridge over the Passaic River. This is to carry the tracks used by through trains on their way to and from the Pennsylvania Station in New York.

In Philadelphia, in the autumn of 1930, the company opened one of the most modern and complete electrified suburban stations in the world. This is situated near the old Broad Street Station, which had been the focal point of Pennsylvania passenger traffic in the city for 50 years, and all suburban trains were then moved there from Broad Street. Before the opening of this new downtown suburban station, the Pennsylvania Railroad built a concrete arch bridge across the Schuylkill River and constructed on the west bank of the river the first or northern wing of its great new passenger terminal. This new wing, known as the 30th Street Station, serves as the West Philadelphia stop for all suburban trains. The new main building of the Pennsylvania Station takes a leading place among the great passenger terminals of the world.

In Baltimore a programme of tremendous magnitude was put in hand. This includes the construction of two new through tunnels practically parallel to those now in use, and the reconstruction of the latter, and altogether



The new and the old forms of motive power on the Pennsylvania Railroad. On the left is one of the new streamlined electric locomotives of class GG-1 that were specially designed for hauling the fastest and heaviest expresses between New York and Washington. On the right is a "Pacific" steam locomotive of class K4S.

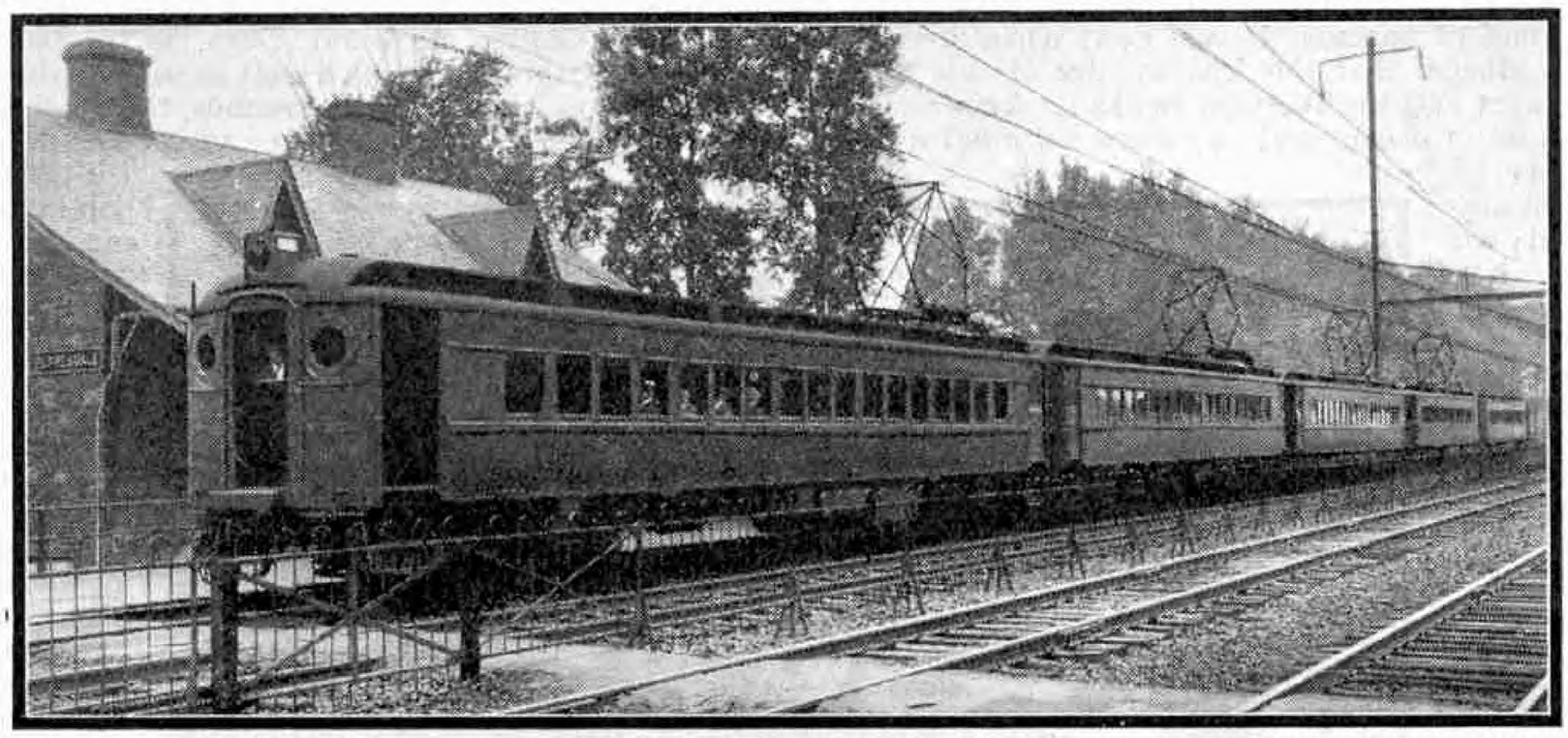
these now afford four express tracks under and through the city. Several outlying grade crossings are eliminated under the new arrangement.

Alternating current of 11,000 volts and 25 cycles is employed. This is the system that has been used for years in the Philadelphia suburban zone. After a great deal of study, the engineers of the Pennsylvania Railroad have concluded that it is best adapted for the heavy-traction trunk line work on the Pennsylvania Railroad. It has dominated electrifications carried out in the Eastern States, with the exception of those of the New York Central and the Lackawanna lines; and it has been used with success in Europe, in Germany, Switzerland and Sweden.

In the Philadelphia and New York suburban zones, which were electrified long before the present programme was taken in hand, the multiple unit type of train already in use is still retained. For through services on the main line it was decided to employ separate electric locomotives, however, and with the assistance of the electrical manufacturing companies several new types of locomotives have been developed. In designing these the chief aims have been to secure the maximum interchangeability of parts, a minimum cost of maintenance, and the simplest methods of manufacture.

The type of heavy-duty passenger locomotive first designed for the new services is known as class P-5. The engines of this class are designed for high speeds, and are capable of 90 m.p.h. They are of the 4-6-4 wheel arrangement, with three pairs of driving wheels 6 ft. in diameter and a four-wheeled bogie truck at each end. They are 62 ft. 8 in. in length, with a weight of over 167 tons, and are composed of three distinct parts, known as the chassis, deck, and cab units respectively, each of which must be completely equipped before the three are assembled to form a complete locomotive.

The new locomotives could not have been built with motors of the types that were available at the beginning of the electrification programme. New motors therefore were designed for the purpose, and there is one for each pair of driving wheels. They fit between the wheels instead of above the frames, so that the dummy axle, or jack shaft, driving the coupled wheels through side rods that were common on earlier electric locomotives are eliminated. The jack shaft arrangement is unsatisfactory for high speed service on account of vibration. The class P-5 locomotive develops 3,750 h.p. or 22,300 lb. tractive power, at 63 m.p.h.



An electric train of the type used in the Philadelphia and New York suburban zones of the Pennsylvania Railroad.

Another class of passenger locomotives is known as 0-1. This has two pairs of driving wheels, each pair driven by two motors, with two four-wheeled bogie trucks, one at each end of the engine, giving the 4-4-4 wheel arrangement. The 0-1 class locomotive develops 2,500 h.p. at 63 m.p.h.

Since the completion of the electrification throughout, streamlined electric locomotives have been introduced for express trains. These giants are rated at 4,620 h.p. and have a tractive effort at starting of 72,000 lb. They have the 4–6–6–4 wheel arrangement, the chassis of each engine being formed of two articulated units. These locomotives are classed 99-1 and are probably the most powerful high-speed passenger engines in the world.

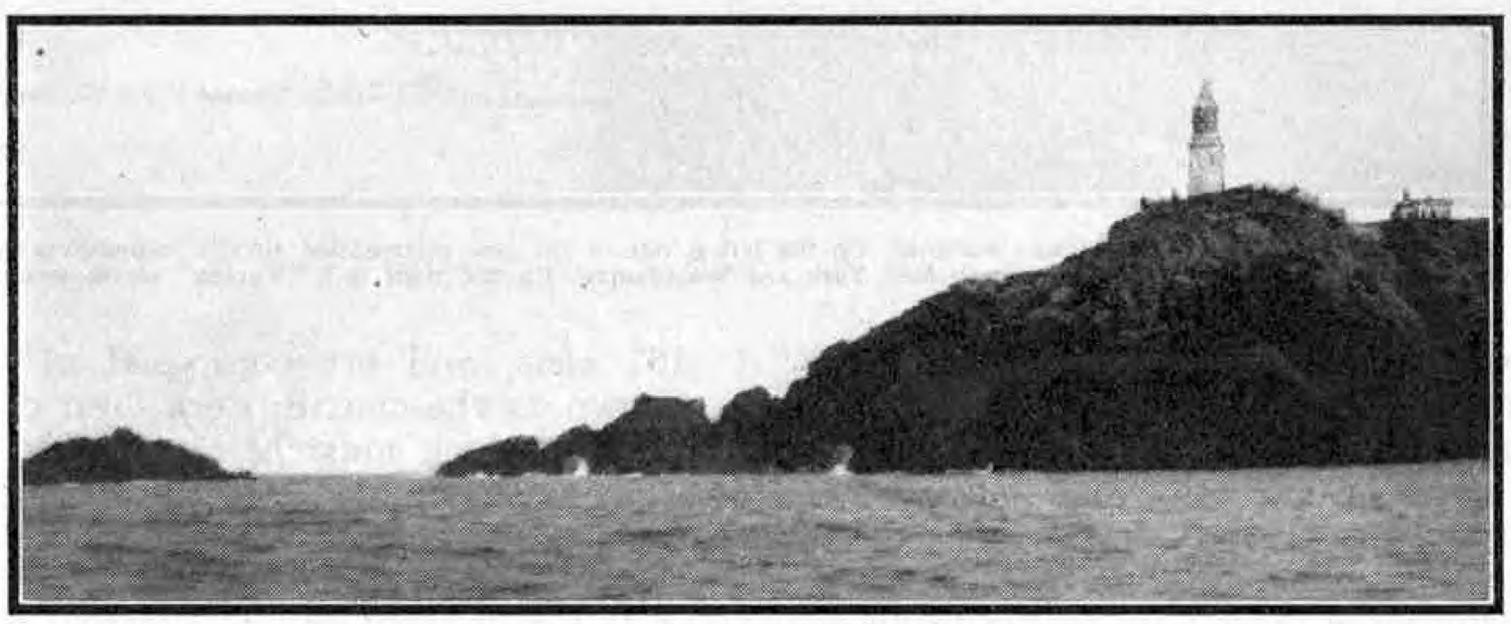
For freight service, only one type of engine is used. This is the 2-8-2 class L-6, which has four pairs of driving wheels and leading and trailing two-wheeled trucks.

Motor Boat Trip among the Scilly Isles

A Delightful Day's Outing

By O. S. Nock, B.Sc., D.I.C.

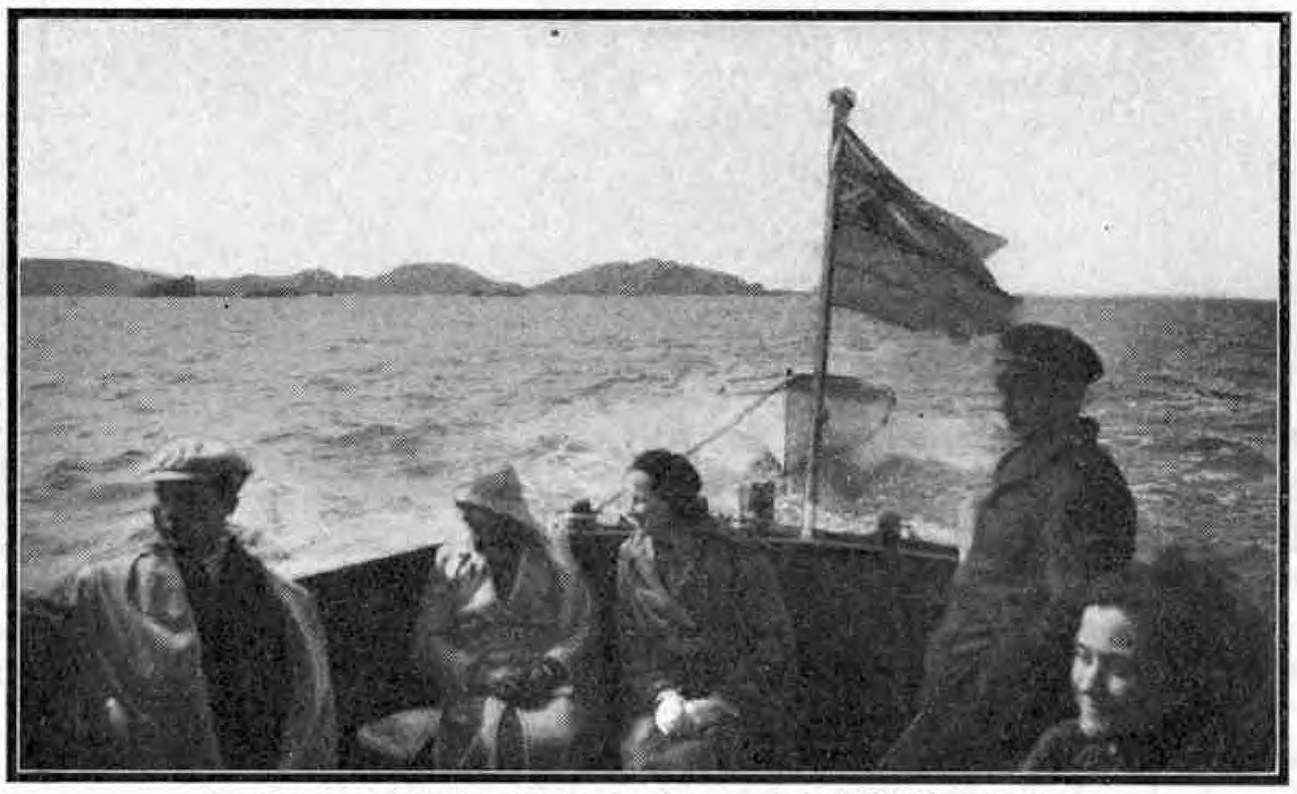
IN the July *"M.M."* I described the voyage from Penzance to the Scilly Isles; in this article I give a brief account of a motor boat trip among the islands. At Hugh Town quay we boarded a trim little motor boat, the *"Zedora,"* and with a snow-white dinghy astern, surf-riding on the end of a rope, we headed for Tresco. As we crossed the water more and more islands came into view—the white sands of St. Martin's, the Eastern Isles silhouetted against the sun, and then St. Agnes, and Gugh lying to the south-west. Half way across the sound is one of the very few points in the whole archipelago from which practically all the larger islands can be seen at once. Then, as the boat drew nearer, Tresco was revealed as a veritable fairy isle. The sands are the purest silver-white, sub-tropical gardens are ranged below a hillside clothed with lovely woods; but the landing place is a wild spot strewn with outcrops of granite.



The lighthouse on Round Island, the northern outpost of the Scilly Isles. The lighthouse men are hauled to the summit of the island by a life-line from a small island to the south.

Although she has a draught of only 2½ ft. the water is not deep enough for the *"Zedora"* to swing alongside the rocky ledge that is used as a pier, and so the picnic parties are rowed ashore in the dinghy. Soon we were off again, and making a south-westerly course towards the southern end of Samson. It was now, when steering away from the larger islands, that the true wonder of this little voyage began. Only Annet and the Western Rocks lay between us and three thousand miles of ocean, and out there six miles away rose the graceful tower of the Bishop Rock lighthouse.

Samson, the island we were now encircling, has been uninhabited for the last 80 years. Here is laid the scene of Sir Walter Besant's famous romance *"Armorel of Lyonesse."* According to one of the most picturesque of Cornish legends, the Scilly Isles are the last fragment of the ancient land of Lyonesse, a fair region that stretched from Land's End to the Bishop Rock. Even to-day the Scilly Isles are often referred to collectively as Lyonesse. Samson has a desolate Hebridean look that is accentuated by the ruins of former dwellings, and the slopes of its twin hills form one huge gullery. At breeding time it is an extraordinary sight, for crowds of birds may be seen nesting on the open turf all over the hillsides.



Looking back from the "Zedora" when passing off Hell Bay, Bryher.

By this time the *"Zedora"* had veered round and was making a course approximately north north-west through an archipelago of tiny islets. Bryher lay on our starboard beam, and still farther to the right, glimpsed through the channel between Samson and Bryher, was Tresco once more.

But fascinating as the larger islands are, for me at any rate the north-western reefs have an even stronger appeal. From a motor boat the horizon is one long line of heaving sea, breaking up these isolated rocks, often washing right over them; and it is odd to think that these granite stacks are just the topmost pinnacles of mountains rising high above the sea bed. Some of the most dangerous of the Scillonian rocks are those whose summits lie just beneath the water. Of these the Bishop Rock is the most famous.

After passing between Gweal and Scilly Rock the fringe of sheltering reefs is left behind, and the northern extremities of Bryher and Tresco are exposed to the full force of the ocean. The coast of Bryher swings back in a wild place called Hell Bay—one of the very few names in Scilly suggesting the terror that the islands may be in times of storm. Even to-day, under almost cloudless skies, a tremendous swell was running and the rocky shore was one long line of leaping waves. The *"Zedora"* leaped and plunged, the dinghy behind tossed like a cork. Ahead of us a most arresting scene opened out. A mile and a half away were the triple stacks of Men-a-vaur, and just peeping out beyond was one shoulder of Round Island with its snow-white lighthouse. Soon, with a spit of sand running out towards us from rocky St. Helen's, we were nearing Men-a-vaur. Approaching from the west this tiny island looks much the same as many another in Scilly; the crags are sharp and splintered and the waves are fairly boiling all round. Then, as the boat passes abeam, the island is strikingly revealed cleft as with an axe into three portions. This glimpse lasts but a few seconds, the chasms are quickly hidden, and Men-a-vaur looks solid once again. This curious formation gives the island an appearance something like a three-masted sailing ship when seen afar off.

So we came to Round Island. The lighthouse here, which is built on the north face of the rock, is not so isolated as the Bishop, but is nevertheless difficult of access. The sea is rarely quiet, and bringing a boat alongside the rocky landing place is usually a hazardous business. Relief men and provisions are landed in a little cove wedged in between Round Island itself and a still smaller rock lying immediately to the south. Landing steps have been cut in the steep granite wall, up which the lighthousemen make their way to the top of the smaller rock. They are then hauled by a life-line across the deep and narrow cleft separating the two islands, and so reach the summit of Round Island itself. Even this comparatively sheltered landing is impossible in very bad weather, and the men in the lighthouse go unrelieved.

We circled right round the island—even on this fair day the waves were leaping angrily over the landing steps—and so headed for St. Mary's again by the same route as we had come. All the rocks were seen in a different guise, the changing lights in sea and sky produced a continuous kaleidoscope of intense colour, and with the sea birds wheeling incessantly around one carried back a wonderfully vivid impression. But never, with all their wildness and dangers to navigation, can one remember the outer isles as anything but lovely.

A Fine New Zealand Viaduct

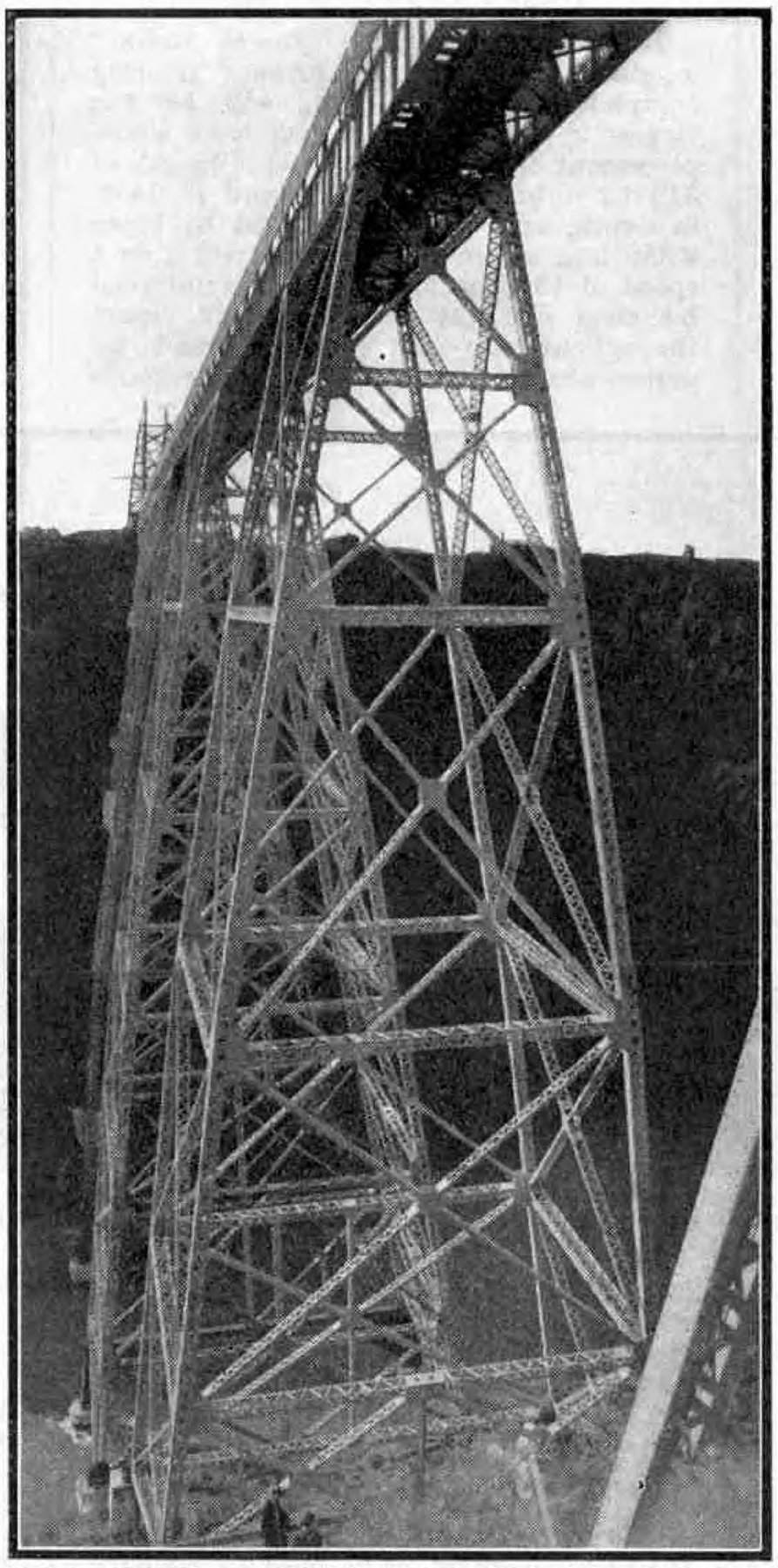
The Highest in The Southern Hemisphere

THE splendid viaduct shown in the illustration on this page is one of the greatest engineering structures yet built in New Zealand. It is in the Northern Island, and was built to carry the extension of the East Coast Railway from Napier to Gisborne over the gorge of the Mohaka River. It is the highest bridge in the southern hemisphere, and was opened on 30th June of this year by the Hon. Mr. R. Semple, Minister of Public Works.

Speaking at the ceremony, the Hon. W. E. Barnard, Speaker of the House of Representatives, said "Every New Zealander must be proud of such an achievement as the Mohaka Viaduct. The driving energy of the Minister of Public Works should be credited with much of the success of this work. Locally this job is known as 'Bob Semple's Meccano Set'."

When viewed from the gorge below, the viaduct is seen to be a really imposing structure. It is 911 ft. in length and towers over 300 ft. above the bed of the river, with its huge steel piers straddling out from the deck to their concrete bases far below. About 1,850 tons of steel were employed in its construction, and it contains some 450,000 rivets. The work was completed in 10 months, and the total cost was £110,000.

The viaduct was designed in the Public Works Department of the New Zealand Government, and special methods were evolved to meet the difficulties of erection. Twin cableways of 1,000 ft. span were specially manufactured in England and shipped out to New Zealand. They were suspended between temporary wooden towers, one on each side of the gorge, and were employed for the transportation of men and materials needed for the construction of the foundations and the girder work of the piers.



"Bob Semple's Meccano Set." The Mohaka Viaduct, New Zealand, the highest in the southern hemisphere.

The steel for the viaduct was fabricated at a New Zealand foundry in Turanga, and every section was carefully marked before despatch to the site of operations, so that it could be placed in position by the builders with the maximum facility. The largest steel sections weighed 7½ tons, but girders weighing 24 tons also form part of the structure. All the steelwork was handled by the twin cableways, the huge girders being placed centrally between the tower legs with their aid in readiness for transfer to their final position by means of special gantry equipment.

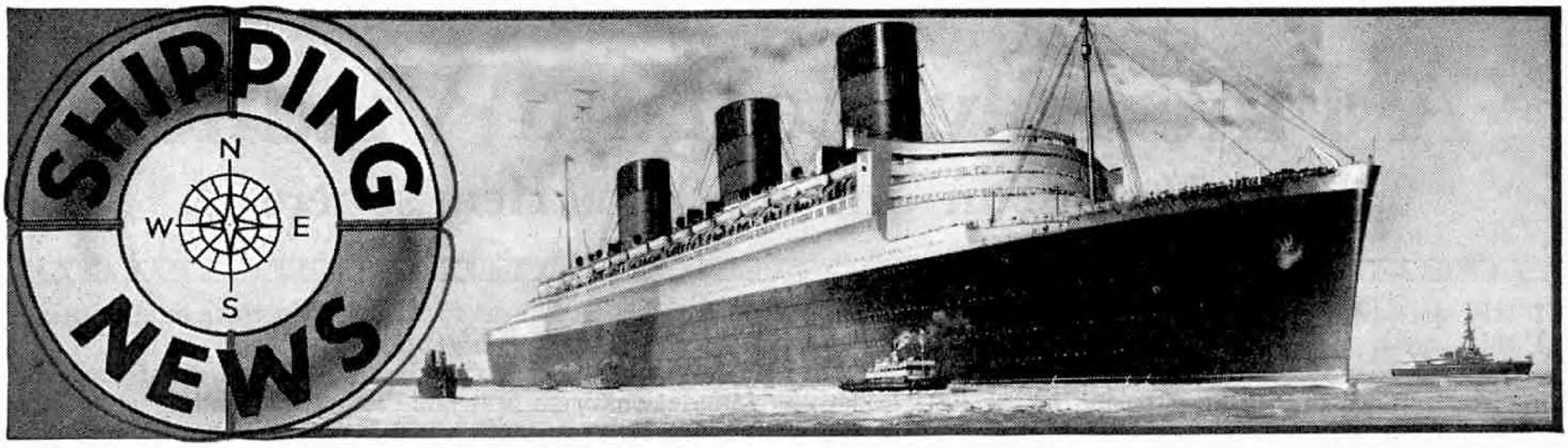
In actual constructional work the reinforced concrete foundations were first laid. Those for the largest towers were sunk to a depth of 70 ft. below the surface of the swiftly-flowing river, and others were embedded in the rocky walls of the gorge. Then the steelwork masses of the towers rose gradually upon them. At their base the largest towers are 110 ft. wide, and each of their four legs transmits the weight of approximately 100 tons of steel to the concrete piers.

Each leg is secured to its foundations by four huge steel bolts, 3½ in. in diameter, and the whole structure has been made strong enough to withstand the shock of the earth tremors that occasionally are felt in the district, and of the violent storms that are experienced. It is calculated that the bridge could withstand a wind pressure of 50 lb. per sq. ft.

The deck of the viaduct was the last part of the project to be completed. This is not on the very top, as often is the case with structures of this kind. Instead it is so placed that the track crossing the viaduct passes between long lines of steel girders, above which are heavy steel guards to give the necessary protection from the wind. The first spans of deck steel were laid on each side of the gorge while preliminary work was being carried out on the central piers, and the spans were finally united in the middle of the viaduct.

The opening of the Mohaka viaduct and of the new railroad in which it forms an important link, will open up a large stretch of fertile agricultural country that previously was comparatively isolated, in spite of recent improvements in road transport.

The Mohaka viaduct is easily the highest in New Zealand. Previously that distinction was held by the Makatote Bridge, near Raurimu on the Auckland to Wellington railway in North Island, which has a height of 260 ft. and is 860 ft. long. Other giant viaducts include the 932-ft. span across the Hapauwhenua Valley, which is only 147 ft. high, and the Makohine Viaduct, near the town of Ohingaite, which is 750 ft. long and 238 ft. in height.

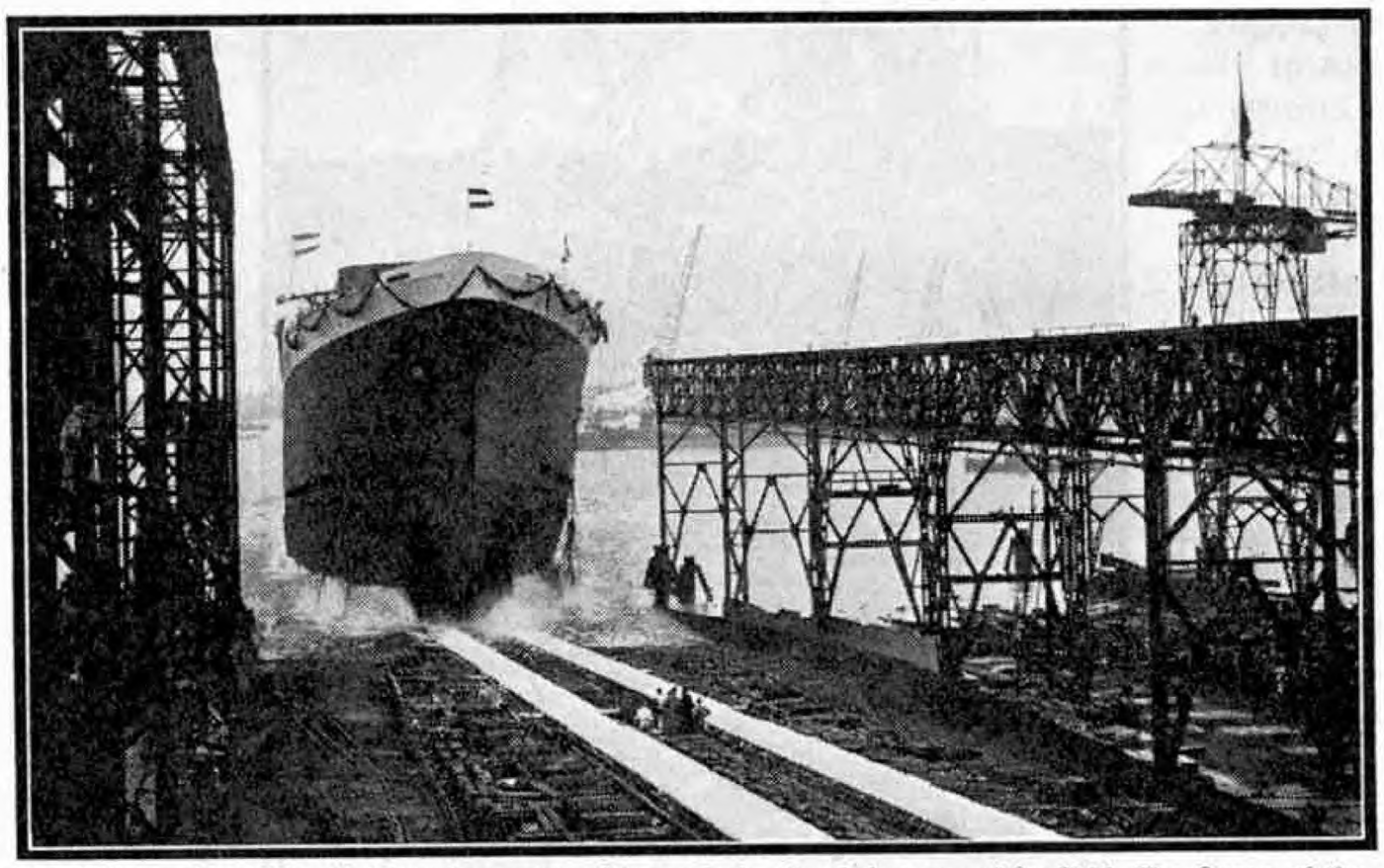


Largest Vessel Yet Built in Holland

Good progress is being made in the fitting out of the *"Nieuw Amsterdam,"* the largest vessel yet constructed in Holland. She was launched in April by the Queen of the Netherlands at the yard of her builders, The Rotterdam Dry Dock Co. Ltd., and on her completion next spring will take up service on the North Atlantic route as the flagship of the Holland-America Line, her owners.

The *"Nieuw Amsterdam"* is designed as a twin-screw turbine passenger vessel of about 36,000 tons gross, having an approximate length and breadth of 751 ft. and 88 ft., respectively. She will have an attractive appearance when finished, for the stem is well raked and the upper part curves slightly forward. The foot of the bow is of novel design, being cut smartly back near the 15-ft. draught mark, and running in a straight line to the keel at an angle of about 40 deg. to the base-line. Two raked funnels, each about 40 ft. in height, are being fitted. Accommodation will be provided for 1,144 passengers, with a crew of 705.

The turbine propelling machinery will have an output of 17,000 s.h.p. on each of the two shafts, steam being supplied from six Yarrow-Schelde boilers. Electric power will be provided by three turbo-generators each of 1,000 kW output capacity, and two Diesel generators, each of 425 kW.



The "Nieuw Amsterdam" takes the water with a splash after being named by H.M. The Queen of the Netherlands last April. A scene at the shipyard of The Rotterdam Dry Dock Company, by whose courtesy this photograph is reproduced.

"Normandie" Creates New Records

In August the French liner *"Normandie"* set up new speed records for the Atlantic crossing in both directions. On the outward voyage she covered the distance from the Bishop Rock to the Ambrose Lightship in 3 days 23 hr. 2 min., at an average speed of 30.58 knots, and her return trip took 3 days 22 hr. 7 min., her average speed being 31.20 knots. In the course of the voyage she travelled for long periods at a speed of 32 knots.

During this round trip the *"Normandie"* made other notable records. The westward trip was the first ever made in less than four days, and at an average speed of over 31 knots, and the fastest day's run in the story of the Atlantic crossing was made on the fourth day, when 781 miles were covered.

World's Largest Icebreaker

It is claimed that the *"Joseph Stalin,"* a giant icebreaker at present nearing completion at Leningrad, will be the largest in the world. She will have a displacement of 11,000 tons, with a length of 348 ft., a breadth of 76 ft. and is 65 ft. in depth, and will be propelled by three 3,350 h.p. steam engines that will give a speed of 15½ knots. The hull is reinforced by steel ribs set just over 1 ft. apart throughout the ship's length, and by plates nearly 2 in. thick on those parts that will receive the full impact and pressure of the ice. Accommodation is provided in the stern of the ship for a large hydroplane, two small aeroplanes, and a catapult to launch the aircraft into the air.

Greater Power from Ship's Propellers

One of two tugs for use in the Fish Docks at Grimsby, to be built by Richard Dunston Ltd., of Thorne, for the L.N.E.R., is to be fitted with the Kort Nozzle, a new development in ship propulsion. This device was evolved during experiments in Germany to eliminate erosion of canal and river banks and beds due to the wash of passing vessels. A streamlined steel nozzle fitted around the propeller of the test vessel, just clear of the tips of the blades, prevented this action, and an unexpected feature was that greater towing-power was developed than when using an unprotected propeller. The increase in power in some of the trials was more than 50 per cent.

Three New British Battleships

The three British battleships now being built under the 1937 Naval programme will be named *"Anson," "Jellicoe"* and *"Beatty."* They are being constructed by John Brown and Co. Ltd., Swan, Hunter and Wigham Richardson Ltd., and the Fairfield Shipbuilding and Engineering Co Ltd., respectively. Each ship will cost approximately £8,000,000, and it is expected that their construction and fitting will provide continuous employment for 3½ years.

The new vessels will be generally similar to the *"King George V"* and the *"Prince of Wales,"* which were laid down early this year by Vickers-Armstrongs Ltd., at the Naval Yard at Walker-on-Tyne, and Cammell, Laird and Co. Ltd. at Birkenhead, respectively. They will have a displacement of about 35,000 tons, and their geared turbines, taking steam from high-pressure water-tube boilers, will give them a speed of about 30 knots. An outstanding feature of the hull will be the defence equipment, incorporating special deck and side armour. The main armament will comprise 14 in. guns, and powerful anti-aircraft guns will be mounted. Accommodation also will be provided for aircraft.

New Thames Motorship

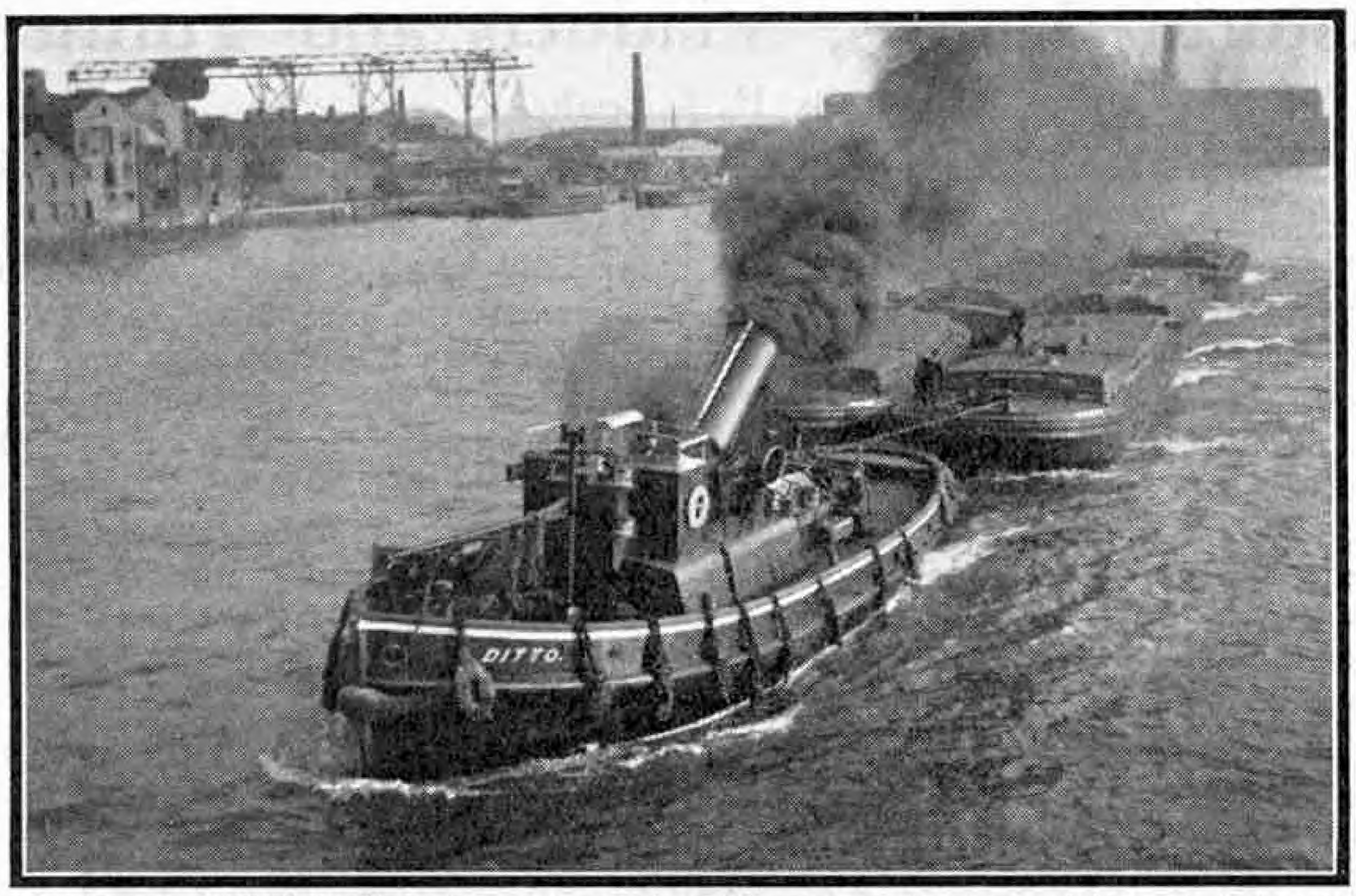
The *"Royal Sovereign,"* a new motorship built by William Denny and Bros., of Dumbarton, recently took up service on the cross Channel routes of the New Medway Steam Packet Co. She has been specially designed for use in the Channel, and has a broad beam with sponsons amidships to steady her in a beam swell. Her hull has a length of 275 ft. and a beam of 35 ft. The propelling machinery consists of two 12-cylinder Sulzer engines with a bore of 360 m.m., and a stroke of 600 m.m., driving twin screws. The total designed output is 4,500 b.h.p., giving a service speed of about 19 knots.

The *"Royal Sovereign"* has replaced the motorship *"Queen of the Channel"* and makes daily trips from Tilbury or Gravesend, Southend and Margate, to Ostend, Calais and Boulogne. The vessel she has displaced has been transferred to the East Coast services.

Tugs with Funnels that can be Lowered

An article on page 586 of this issue describes the various types of tugs of London River. Some of these work in the upper reaches of the Thames, where many of the bridges allow so small a clearance that tugs wishing to pass under them have to lower their funnels. The illustration on this page shows the tug *"Ditto"* with its funnel swung back for this purpose.

The *"Ditto"* is an oil-fired steam tug that is chiefly employed in towing barges containing petrol between storage depots, such as those at Thameshaven near the mouth, and Fulham. The movable part of her funnel is supported on trunnions, and is lowered and raised by hand, a lanyard passing round a pulley wheel fitted to its top. The funnel is balanced by means of counterweights, so that little effort is needed to move it. So well balanced are some of the funnels of tugs in which this practice is followed that, in the words of a Thames river man, "an ounce of tobacco can be weighed on them."



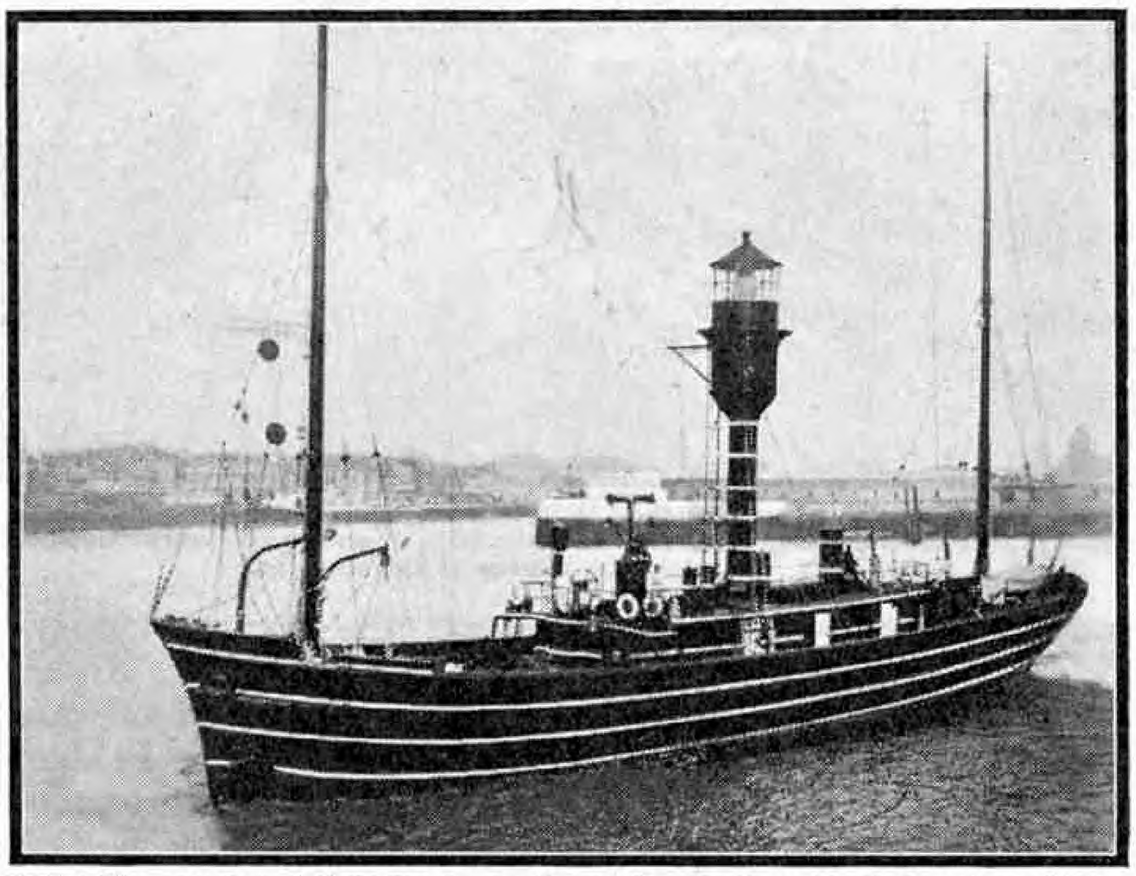
The Thames tug "Ditto" with her funnel lowered in readiness to pass under a low bridge. Photograph by W. P. Conolly, London.

A New French Lightship

The striking vessel shown in the lower illustration on this page is a new lightship recently built for use at Dunkirk, France. It has been named *"Dyck,"* after the shallows near which it is to be anchored, and together with the lightships *"Sandettié"* and *"Rytingen,"* it is intended to improve the lightship and buoy service in the southern region of the North Sea.

The *"Dyck"* was built at Le Havre by the Société des Forges et Chantiers de la Méditérranée, and has an overall length of 158 ft., a breadth of 22 ft. 9 in., a draft of 16 ft. 9 in., and a displacement of 52 tons. The hull is of a design standardised for all French lightships, and has been galvanized to reduce corrosion and to facilitate maintenance. Stability is ensured by 100 tons of cast-iron attached to the keel.

The power required by the lightship is generated by four Sulzer airless injection two-cylinder Diesel engines. Two of these develop 60 b.h.p. at 490 r.p.m., and the others 16 b.h.p. at 750 r.p.m. Gas oil is used for the Diesel engines as well as for cooking and for the central-heating boiler.



"Dyck," a new French lightship for service on the southern North Sea coast. Photograph by courtesy of Sulzer Bros. (London) Ltd.

The larger Diesel engines are started by means of compressed air, and each drives a 42-kW generator and an air compressor that can be uncoupled when not required. The power from the generators is used for the larger auxiliary machinery, particularly the winches. The vessel has electric propulsion, power being provided on the few occasions necessary by the two generator sets run in parallel. The motor has an output of 100 b.h.p., which gives the vessel a speed of 6.5 knots.

The 16 b.h.p. engines can be started either by hand or by compressed air, and each drives a 10-kW generator. These supply the power required for the auxiliary machines at times when the load is not sufficient to justify running one of the larger engines.

The main rotating light is fitted with a 3,000-watt lamp. This remains horizontal when the vessel is rolling or pitching, for it is balanced by a counterweight through a joint in the lower part of the suspension device. The radio installation of the vessel comprises two transmitters, and a direction-finder. The fog-horns of the vessel are operated by air supplied from a compressor at a pressure of 28 lb. per sq. in.

Tyne's Second Largest Liner

The keel was recently laid down at the shipyard of Swan, Hunter and Wigham Richardson Ltd., of Wallsend-on-Tyne, of a passenger and cargo liner that will be the largest vessel built on the Tyne since the *"Mauretania"* in 1907. She will have a gross tonnage of about 26,500, and has been ordered by the Shaw Savill and Albion Line.

The Institute of Marine Engineers

Arrangements are now being made for the next annual examination for admission to the Student class of membership of the Institute of Marine Engineers, which will be held on May 23rd–31st, 1938, in London and other centres. The examination for admission to Associate Membership to the Institute is to be held on 16th–19th May next. Full particulars of these examinations and of any exemptions that are allowed may be obtained on application to the Secretary, The Institute of Marine Engineers, The Minories, London, E.C.3.

All apprentices and students who wish to become marine engineers should endeavour to qualify for membership of The Institute. The first step is to become a Student Member of the Institute, which can only be done as a result of examination. Applicants for admission to the Student Section must be under 25 years of age and have completed at least one year of attendance at day or evening classes at an approved educational institution, as part of a regular course of training in the science of engineering or naval architecture. The possession of certain degrees or diplomas exempts the holder from sitting for the preliminary examination.

Italian Motor Boat Record

A new speed record for motor boats of the 1,200-kilo class has been set up by Count Rossi, the Italian racing pilot. In the *"Alagi,"* driven by an Isotta-Fraschini engine, he recently averaged 146.532 k.p.h., or 90.89 m.p.h., over the measured mile at Arona, Lake Maggiore. His fastest run was made at 91.196 m.p.h.

Salvage Work at Scapa Flow

A notable salvage feat was recently completed when the upturned hull of the 25,000-ton battleship *"Friedrich der Grosse"* was moored at the breaking-up yard of Metal Industries Ltd., Rosyth. This vessel was a flagship during the internment of the German Fleet in Scapa Flow and was the first to be sunk when that Fleet was scuttled. She lay keel upwards in 23 fathoms of water and had a heavy list of about 16 deg. to port.

Preliminary steps towards raising the vessel were commenced in June 1936, and actual work on her started early in the following month. She was brought to the surface with the aid of 10 air locks, and towed in to shallow water, where the superstructure was blasted away. She was then towed to Rosyth.

The work of breaking up will occupy nine months, and the hull is expected to realise about £15,000 as scrap metal.

Some Railway Engineering Feats

Historic Bridges, Viaducts and Tunnels

By H. J. Locke

THE building of streamlined locomotives and coaches for special services, the breaking of speed records and the running of many hundreds of additional trains to and from all parts in connection with national events and Bank Holidays, are facts that keep the British railways perpetually in the public mind. The railways have welcomed and assisted in the development of travel by air. The drone of the aero engine cannot still the fascination of the locomotive whistle, however, and the steam locomotive remains industrially essential and at the same time humanly thrilling.

Much is heard of the mechanical engineering triumphs of the railways. Little is known of the work of the civil engineer. All over the country there can be seen examples of the mighty engineering tasks that have been accomplished to carry railway tracks across valleys, rivers and even arms of the sea. Many of these stand as perpetual monuments to the courage and skill of the engineers who undertook this pioneer work, in some cases 100 years and more ago.

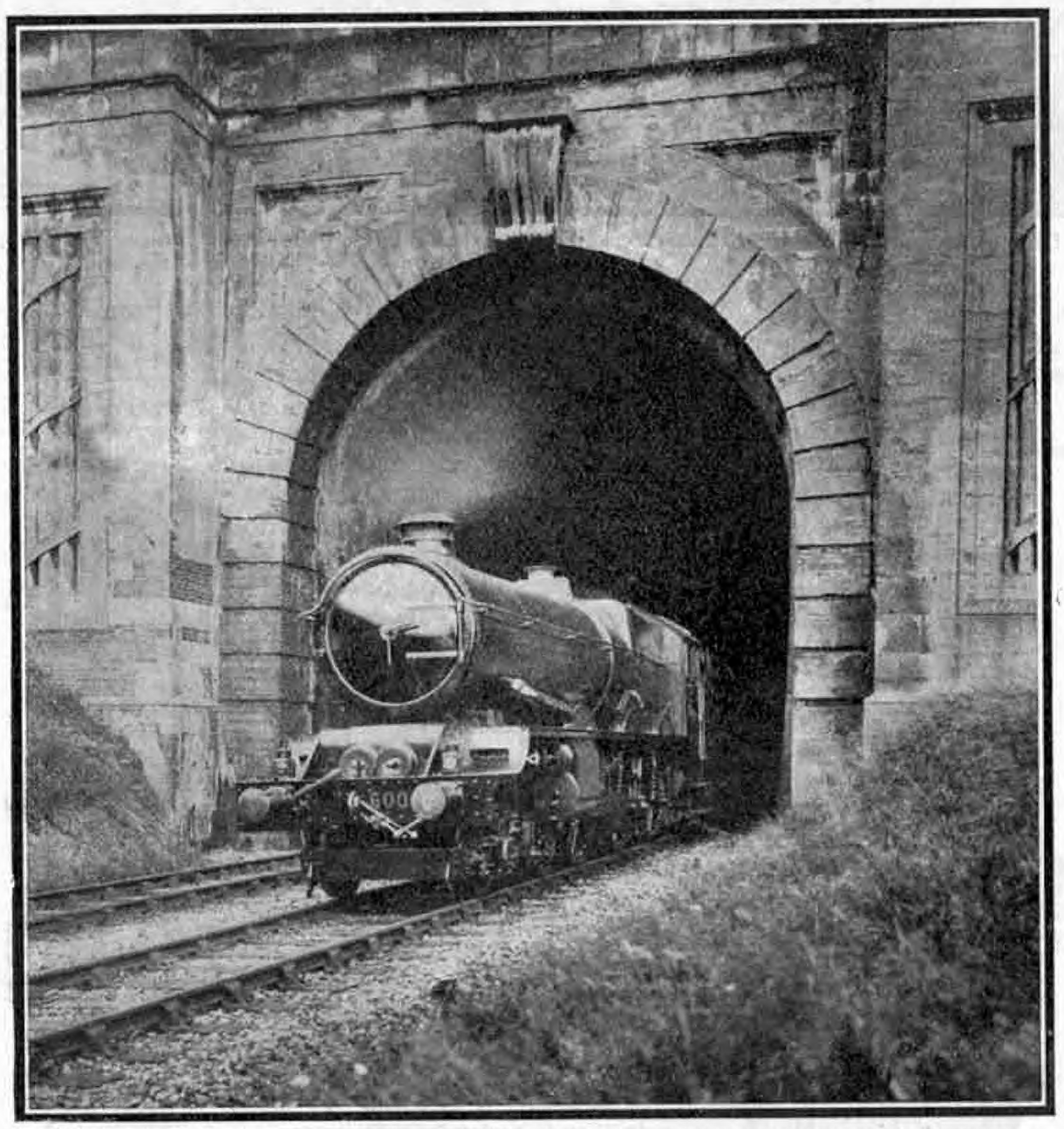
The Forth Bridge, which was opened as long ago as 1891, bears tribute to the skill, daring and courage of the men who built it. It cost £3,000,000 to construct, and its three towers rise 361 ft. from sea level, more than the height of St. Paul's Cathedral. It needed 54,000 tons of steelwork and 6,500,000 rivets before the bridge could carry the railway metals across the Firth of Forth. It is built on the cantilever principle, and including the north and south approach viaducts constructed on the shores of the Forth it measures 1½ miles in length.

Another wonderful structure, which was built in 1850 by that great engineer, Robert Stephenson, is the Britannia Tubular Bridge that carries the L.M.S. line across the Menai Strait in North Wales. The basis of the design of the bridge was the use of two continuous rectangular tubes of wrought iron. Each of these is 1,510 ft. long and some 4,680 tons in weight, and three supporting towers were set up in the middle of the straits to carry the two main spans, which are 459 ft. across. The tubular bridge is the principal connecting link with Holyhead for the Royal Mail steamer service to and from Ireland. It has safely carried the *"Irish Mail"* trains between the mainland and the Isle of Anglesey since its opening 87 years ago.

Away in the West Country across the River Tamar is the beautiful Royal Albert Bridge at Saltash, built in 1859 by the world-renowned engineer, Isambard K. Brunel, whose name appears on the end of the bridge. This was Brunel's masterpiece, and over it G.W.R. metals pass from Devon into Cornwall. It is 2,230 ft. long and is made up of two main spans and 17 land spans. The main spans are each 455 ft. in length and weigh 1,060 tons. The bridge is 110 ft. above high-water level and took four years to build. The opening ceremony was performed on 3rd May, 1859, by the Prince Consort, after whom it was named the "Royal Albert Bridge."

Hundreds of other lesser-known bridges and viaducts have been constructed by railway engineers, and each plays a vitally important part in the daily working of our great railways. Indeed the L.N.E.R. route to Scotland is often referred to as the "Great Bridges Route." It includes the Forth Bridge previously mentioned, and also the Tay Bridge, across the Firth of Tay. In addition there are Welwyn Viaduct, the Nene Viaduct at Peterborough, the Trent Bridge at Newark, a swing bridge at Selby, Durham Viaduct, the King Edward VII Bridge at Newcastle and the Royal Border Bridge at Berwick, all of which are crossed on the northbound run of *"The Flying Scotsman."*

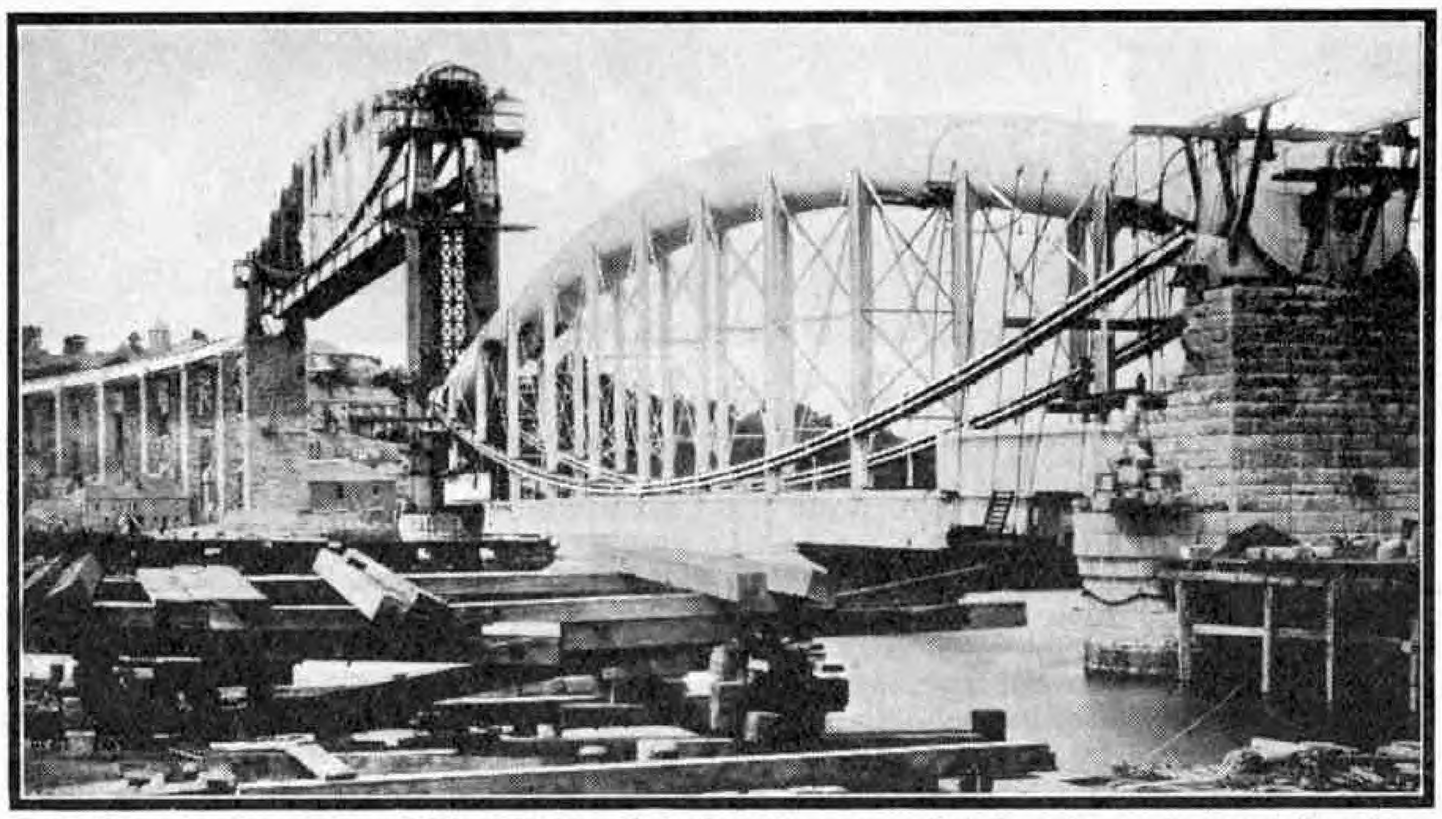
The task of boring railway tunnels has been no less arduous than that of erecting bridges and viaducts, yet perhaps even less has been heard of the trials, hardships and ultimate triumphs of the men engaged on their construction. Perhaps the greatest feat of railway tunnelling in this country was the construction of the Severn Tunnel, which is the longest under-water tunnel in the world. It is 4 miles 628 yards in length, and at its deepest part is 138 ft. below high-water level. The tunnel cost nearly £2,000,000, and took thirteen years to build. Its opening for traffic in 1886 reduced the railway journey



The handsome mouth of Box Tunnel on the G.W.R. This tunnel was so disliked in the early days of railways that timid passengers used to leave the train at one end, journey "overland" by coach, and rejoin the railway at the other end.

time between Cardiff and Bristol and London by an hour, and paved the way for the great industrial development of South Wales.

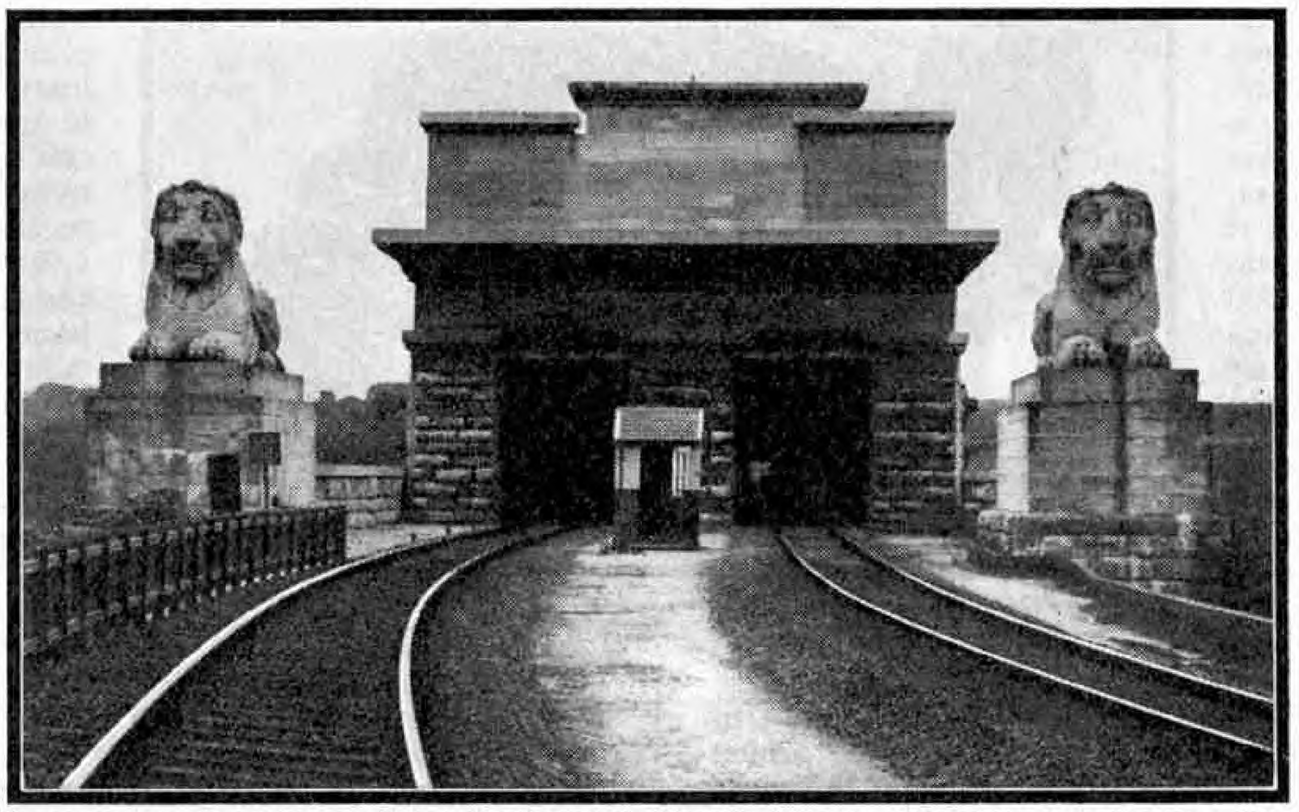
The second longest railway tunnel in Great Britain is on the L.M.S. line at Totley in Derbyshire, and is 3 miles 950 yards in length. The third longest tunnel is also owned by the L.M.S. This is at Standedge and is 3 miles 60 yards long. The only other railway tunnel in this country over 3 miles long is on the L.N.E.R. line between Manchester and Sheffield at Woodhead in Derbyshire. This tunnel is 3 miles 13 yards in length. Altogether there are 1,042 tunnels on the British railways, of which 45 are between one and two miles long. Five of them have a length of between two and three miles.



Brunel's masterpiece, the Royal Albert Bridge at Saltash, under construction. One of the main spans is in position, and preliminary work towards the raising of the other is in hand. Photograph by courtesy of the G.W.R.

When tunnels were first built on the railways difficulty was sometimes experienced in getting passengers to go through them for fear that the sides or roof would collapse. Box Tunnel on the G.W.R. was one that was particularly disliked, and at one time trains used to stop at one end to allow passengers to travel by coach to the other end, where the trains took them on again! The fear and dislike of travelling through tunnels was soon overcome when passengers realised that they were pertectly safe and were in fact a boon in shortening a journey.

Just as all railway bridges and all track, trains, and other equipment are regularly inspected by experienced men, so are railway tunnels. Tunnels that are near other borings under the Earth, such as coal mines, get even more than their regular share of inspection. Railway gangers patrol the permanent way each day and are responsible for inspecting any tunnels on their particular section of line. By means of instruments with which they are supplied they are able to tell immediately if there is any likelihood of trains fouling the roof or walls, and in the event of any serious fault being found, the tunnel is immediately closed to traffic.



The entrance to the Britannia Tubular Bridge across the Menai Straits. Each of the stone lions guarding the portal weighs 80 tons. Photograph by courtesy of the L.M.S.

In addition to this daily inspection, a special inspection of every tunnel is made two or three times a year by the railway engineers with the aid of a specially-constructed tunnel van. This van has a semi-circular gauge with projecting metal spikes built up on its roof. If any part of the roof has dropped, no matter how slightly, the gauge indicates the spot immediately as the van passes through the tunnel. Bright lights are focussed on the roof, and the spikes are very closely watched by the engineer in charge of the train. If any faults are found, these are carefully marked and repairs are carried out without delay by the engineering staff.

It is not generally realised that tunnel construction does not necessarily involve boring. When a tunnel is to be built fairly near the surface and the ground above is clear, it is often built by what is known as the cut-and-cover method. This involves the making of a cutting, similar to the many railway cuttings all over the country, and then the building of the tunnel lining in the cutting. When this lining is complete the cutting is filled in again over the top, leaving the tunnel enclosed.

The cut-and-cover method was employed for the construction of London's first underground railway, the Metropolitan, which was opened in 1863 from Bishop's Road to Farringdon Street. Another interesting London cut-and-cover tunnel, which is passed over by many thousands of people every summer, but is not very well known, carries the L.N.E.R. line into Marylebone beneath Lord's Cricket Ground. It actually passes under a corner of the famous ground, which had to be opened up at the time of its construction for the former Great Central Railway. When the tunnel was completed the opening was refilled and the turf replaced in position.

In some places it has been found desirable by a railway company to convert a tunnel into a cutting. This of course is done only when the tunnel lies near the surface, and reconstruction becomes necessary owing to the difficulty of keeping the tunnel in good repair, or on account of widening operations that involve additional tracks. The Chevet cutting on the L.M.S. was once a tunnel. Its reconstruction is of comparatively recent date and it is a good example of a "changeover" from tunnel to cutting. Another tunnel that also has been opened up is the former Cofton Tunnel, on the L.M.S. This was situated at Barnt Green, near Birmingham, on the Midland route to Bristol, and was demolished in three lengths by explosives.



By P. A. Tent

A Young Inventor

Eleven years seems a very early age at which to win fame as an inventor, but Jirzi Zezula of Prague, in Czecho-Slovakia, who is of that age, has already shown signs of genius. The local Society of Inventors have admitted him to their ranks and his work has been displayed at their Exhibition along with that of grown-up members. His latest idea will appeal to all my readers, for he has produced a new form of that favourite schoolboy's weapon, the catapult. The missile is propelled by elastic bands, as usual, but is directed through a barrel like that of a pistol, thus making accurate aim possible. In addition Jirzi has designed a target for use in practice. It consists of a small round wooden plate set in a framework. If the marksman hits the bull's eye a small charge of explosive is fired, and a loud bang tells him of his success.

Engine that Blows Out Fires

An Austrian inventor has devised means of literally blowing out fires by means of vortex rings. Most of my readers know the laboratory experiment in which visible rings of this kind are projected to a distance of several feet and made to impinge upon other objects. One way of producing them is to cover a small cardboard box with a sheet of parchment paper, preferably gummed on, and to cut a small hole, about ½ in. in diameter, in the base. The box is filled with smoke and stood on end, when sharp raps on the parchment cause the rings to be shot out of the hole in the base.

This is the basis of the inventor's device, though the rings need not necessarily be composed of smoke. In the laboratory by using vortex rings he can extinguish a candle at a distance of six yards, and suggests that larger air rings projected against a burning house from distances of 60 yds. or more would cause the extinction of the fire. The engine he suggests would breathe carefully aimed puffs of air in the form of vortex rings at the burning building.

Machine for Typing Music

Ever since the invention of the typewriter, many inventors have studied the problem of making a machine with which music can be typed. Various difficulties have caused the failure of all previous efforts, but it can now be claimed that these have been overcome, for after 12 years of systematic preliminary work, a music-typing machine has been successfully constructed by Gustav Rundstatler, a German inventor.

When copying music mechanically the single notes and signs must be inserted at different levels in the staff, and also above and below it. This at once introduces factors that are quite unknown in ordinary typing. Moreover, the transcription of music involves the employment of far more signs than are required for written words. Yet it was necessary to make a start on the principle of the ordinary typewriter, if there was to be any reasonable hope of constructing a machine that would produce copies of music.

In previous attempts a fundamental error had always been made that doomed them to failure. Paper was selected on which the staff lines were already ruled, and the notes therefore could only be copied correctly if the lines corresponded exactly with the dimensions of the machine parts. In addition, it was essential that the sheet should be placed in the machine very accurately. It was rarely possible to satisfy all these conditions, quite apart from the fact that there was no possibility of making extra copies, which is of course one of the chief advantages of the typewriter and also of this invention.



A music typewriter. With this machine, which is the work of a German inventor, a standard line of music can be written in from two to three minutes.

Rundstatler's machine, called the "Nototyp," produces on white unprinted paper the staff and the notes, with all necessary markings, and the copying of a standard line takes only two to three minutes. All kinds of music can be transcribed, ranging from the simplest popular song to the most complicated score.

The machine can make 30 times as many signs as the ordinary typewriter and by the ingenious arrangement of the key-board can be operated at a remarkable speed. Yet its principles are so simple that anybody who has had some practical training in music can learn to manipulate it in a few hours. Its most striking feature is the method of revolving the roller by pressure on a key, allowing it to be adjusted in 30 different line and switching positions without the operator having to remove his hands from the key-board. The transcription of slanting connecting bars also proved a difficult problem that has been solved by a clever contrivance, and a further device allows several copies to be made at the same time without the slightest difficulty.

On the suggestion of the German Society for the Blind, Rundstatler also took up the problem of adapting the music-copying machine for the use of the blind, and in this he has been quite successful. The blind can be made familiar with the standard key-board very easily. Instead of paper, they will use thin unprinted metal sheets in which the hard steel type makes impressions that they can read by their sense of touch.

Help for the Tram and Bus Conductor

Very often during the rush hours the conductors of double-decked buses and tramcars find it difficult to estimate the number of seats vacant in the upper saloon. They have then to make constant journeys up and down the steps in order to find out whether they are loaded to capacity. Otherwise passengers would be left behind when there were still vacant seats, or the upper deck would be crowded above the regulation number.

An invention that solves this problem has now been introduced. It consists of a glass-fronted box that can be installed at the foot of the stairs in a position where it is easily visible to the conductor and the passengers. Inside the box are square segments, each wired separately to contacts in one of the seats on the upper deck.

As each seat is occupied, its particular segment in the indicator is illuminated, and when all are lit up the word "FULL" is shown in large capitals. A glance at the box shows the conductor how many people can be allowed on the upper deck. Moreover, when the bus is approaching a stop he is warned if any passengers wish to alight, for as they get up to pass down the steps the lights in the segments are extinguished.

The device is not very expensive to install, and tests have shown that it will withstand rough usage without injury. The wiring is simple and can be made unobtrusive, and the contact is fixed at a point in the cushion of the seat where the weight of the passenger can hardly fail to operate it. At the same time precautions are introduced against false indications, and a weight of less than 56 lb. will not illuminate the segment.

A somewhat similar device has been introduced for locating empty seats in cinemas without the necessity of using a flashlight. Small electric lamps are installed at the back of the seats, and are controlled by switches at the ends of the rows. The attendant presses the switch and a tiny ray of light comes from each vacant place. The lamps of the occupied seats are obscured, so there is no difficulty in telling at a glance how many have still to be filled.



A lorry that can be used as an emergency fire fighter, shown in action. Photograph by courtesy of Messrs. J. H. Sparshatt and Sons, London.

A Fountain Pen with Solid Ink

The use of a new type of fountain pen will do away with the necessity of carrying a bottle of ink as well when travelling. This contains a supply of solid ink and is ready for use on being filled with water. It is called the "Camel," possibly because it will carry on some time without water, and its design makes it as easy to handle as the ordinary fountain pen.

The supply of solid ink or ink powder is carried in a cavity in the top of the pen. Below this is a storage chamber, while still further down is a rubber sac provided with a lever for compressing it preparatory to refilling with water. Water drawn in comes into contact with the solid ink cartridge, some of the ink is dissolved, and the pen is ready for use.

When the pen is carried upright in the pocket, the progressive solution of the ink in the water in the reservoir is prevented by the small storage chamber. In this a certain amount of water and ink is held in concentrated form, and is prevented from reaching the reservoir by surface tension, except as needed to keep the liquid in the reservoir at the proper "writing colour." It is claimed that for ordinary use the solid ink cartridge will last for at least a year.

Fire-Fighting with Motor Lorries

The upper illustration on this page shows a lorry that in addition to its ordinary use for the conveyance of goods can be converted in a few minutes into an emergency fire fighter. It is fitted with a platform body so hinged that it can be quickly raised by cable gear, disclosing a canvas tank with a capacity of 600 gallons. This can be filled with water from a hydrant, or from a pond or stream, and then discharged by means of a pump through two hoses at a pressure of 100 lb. per sq. in.

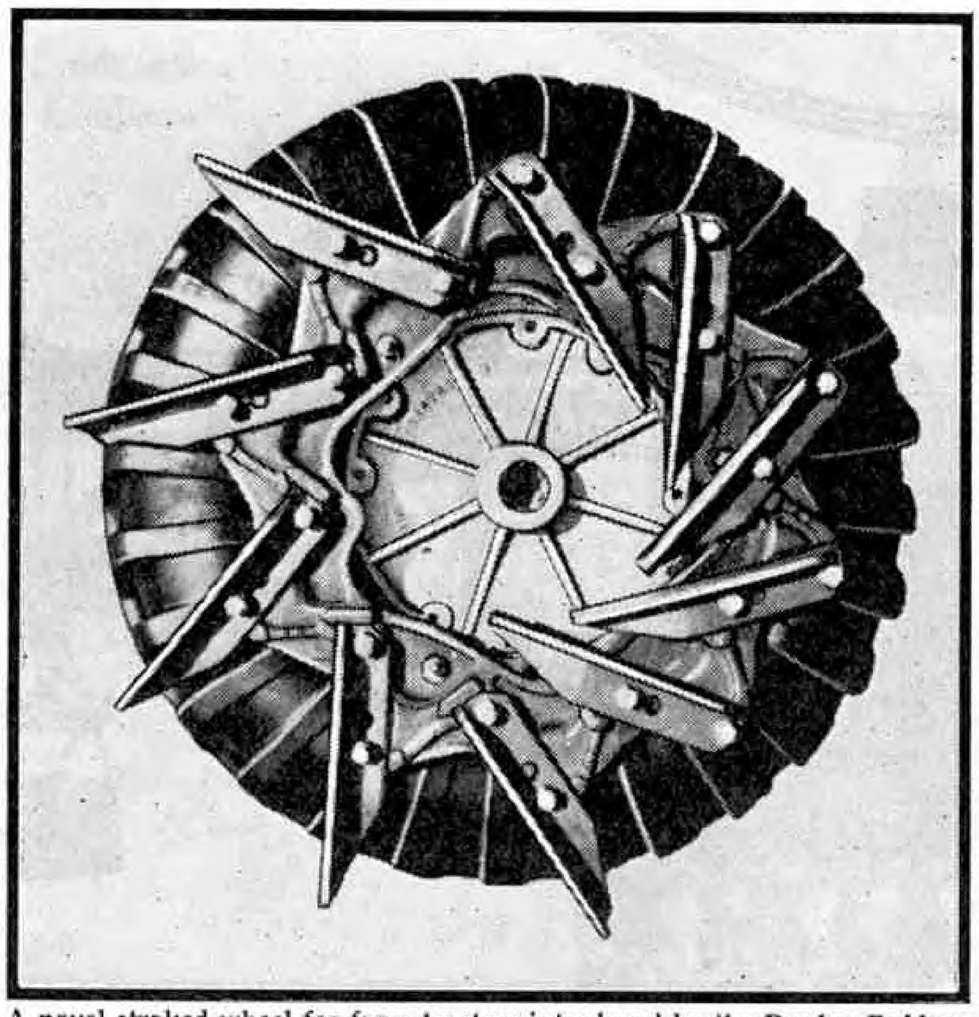
Fleets of these lorries might prove invaluable in a war time emergency, when they could be mobilised very quickly to aid the ordinary fire fighting forces. They could also be used for the dispersion of poison gas, for the tank could be filled with decontaminating liquid and special jets could be provided for its ejection. In peace time the lorry will prove very useful for many purposes, particularly in country districts, where it can be employed by farmers in carrying water to the fields, in spraying the crops and in fighting rick or heath fires, which the ordinary fire-fighting services may be unable to deal with adequately.

An Innovation on the Farm

The lower illustration on this page shows a pneumatic-tyred wheel with retractable strakes, recently introduced for agricultural tractors and other farm vehicles engaged in heavy haulage work. This new type of strake consists of an iron ring to which angle blades are bolted, and has the great advantage that it can be left permanently attached to the tractor.

When the machine is employed on soft or marshy ground, the blades can be turned outward to the working position, as shown on the left-hand side of the photograph. When the tractor is required for haulage on the road or over firm ground, however, they can be turned quite easily to the "in" position. In the event of wear or breakage, the blades can be replaced by the local blacksmith or obtained from the makers at a reasonable cost.

Tests have shown that the strakes will grip under the most arduous conditions, and will readily perform such difficult work as drawing heavy threshing blocks out of the stack yard, perhaps the most strenuous task the agricultural tractor has to perform. A further advantage of the invention is that it dispenses with the weights required on many types of straked wheels.



A novel straked wheel for farm tractors introduced by the Dunlop Rubber Company, to whom we are indebted for this illustration.

Seeing Through Fog

Fog is still a menace that often holds up transport services and takes an immense toll of human life. Air traffic is particularly affected, for although blind flying equipment is employed, the danger of losing height and crashing into some obstruction hidden by fog has not been completely overcome. In England and northern Europe, fog is commonly encountered during the autumn and winter months on many of the regular air routes and the problem is therefore a particularly pressing one.

An apparatus designed to end these dangers has now been invented. The Aldridge Detector, as it is called, is small enough to be mounted in the nose of an aeroplane, although it is also designed for use in ships, and it will give visual or oral warning of any obstruction to a distance of 60 miles. The principle on which it operates is a simple one. It picks up radiation of very short wavelength reflected from these objects and converts it into visual or oral signals. The circuits of the two detector valves in it are tuned to a wavelength of 1.6 microns, or little more than one twenty-thousandth of an inch. Radiation of this frequency is invisible to the human eye, but can penetrate the atmosphere in fog and darkness.

The detector is contained in a square box that weighs only 40 lb. Binocular projections fitted in front form a shield for the "eyes" of the apparatus, which are simply holes that allow the rays used to pass in. The controls and the indicator dial are fitted in a second cabinet, and power is supplied to the instrument from three high tension and two low tension batteries. Improvements are planned to enable the apparatus to indicate not only the presence of an obstruction, but also its actual distance from the aeroplane.

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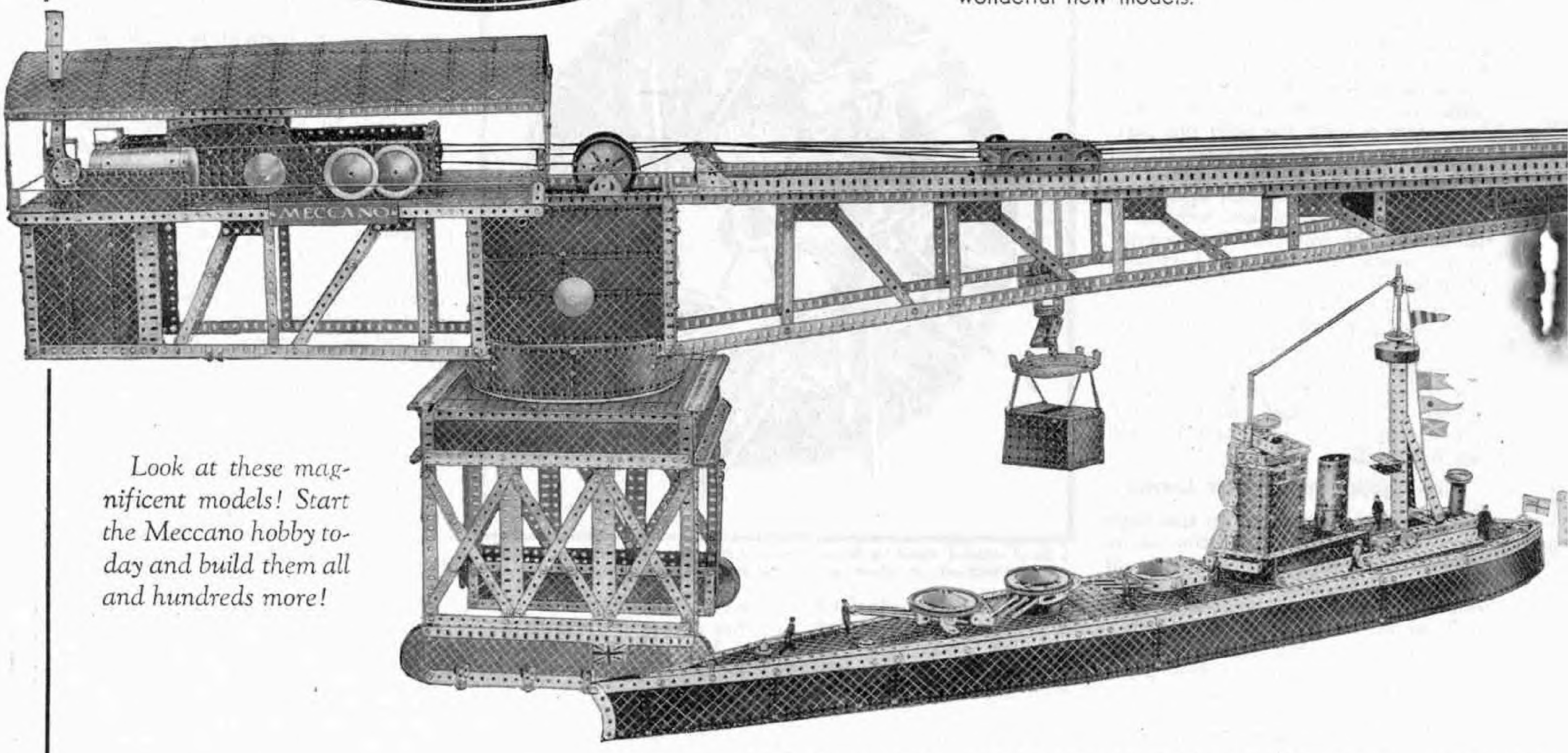
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A Portable Clock Tower

Although the clock tower illustrated on this page looks very solid and permanent, it is really portable. It is designed for rapid erection at important public events where large crowds gather and need a public clock, and it can be quickly dismantled when the event is over. Special packing cases are used to hold the various parts for transit, and the whole tower can be built up in five days and taken down again in three. The clock is used for publicity purposes by *"The Times."*

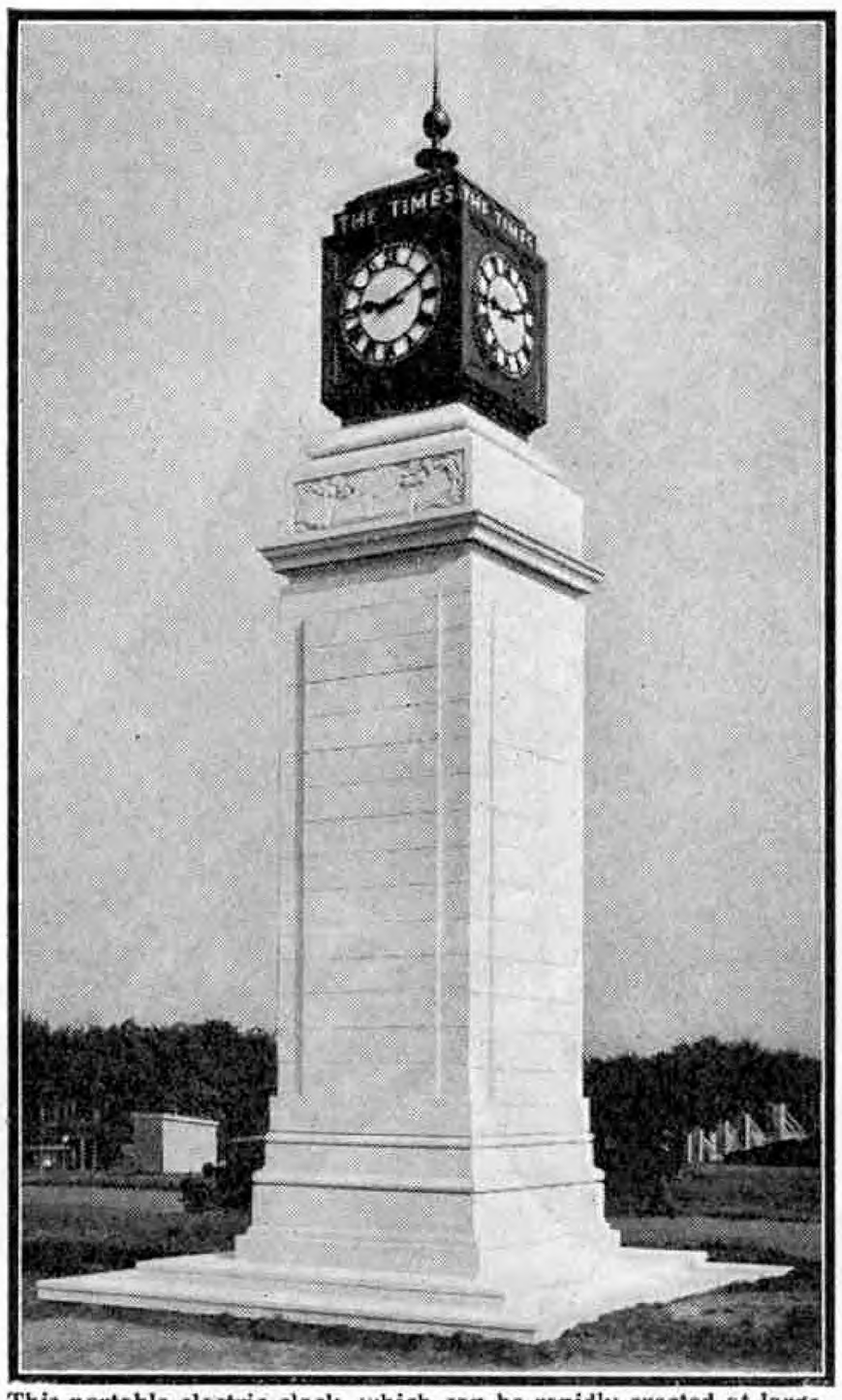
The tower itself is made up of interlocking teak sections, built up on a light steel girder framework, and painted to represent Portland stone. Above the column of the tower is a bronze clock case, with four dials each 3 ft. 7 in. in diameter, glazed and arranged for either electric or paraffin lighting. Above each dial is a pierced panel with the words *"The Times,"* and above this again is a bronze finial, combined with a lightning conductor.

The clock is electrical, being driven by a master clock and a battery fixed inside the tower. Behind each dial is a small mechanism with a 120-toothed ratchet wheel, and half-minute impulses from the master clock step the hands round by moving the wheels a tooth at a time.

The dials are specially designed to give the greatest possible visibility, and the hands also are given a contrasting form in order to make the time easily readable from a considerable distance. The bas-relief design below the dials consists of a dial, a scythe, and three volumes, symbolising time past, present and to come respectively.

The tower was designed for *"The Times"* by Messrs. H. O. Ellis and Clarke, FF.R.I.B.A., and the clock mechanism was constructed by Gillett and Johnston Ltd. The clock has already attracted much attention, and its use for a short time at many places has caused local people to ask for a permanent clock tower.

T. R. ROBINSON.



This portable electric clock, which can be rapidly erected at large public gatherings, has been specially designed for "The Times," by whose courtesy we reproduce this illustration.

Growing Crops Without Soil

Fresh plant food for cattle can now be produced all the year round in a germinating cabinet that in eight days produces eight inches of green fodder from seed. This is effected without the use of soil, the seed being treated with a solution that contains all the elements necessary for growth.

The cabinet itself is made of iron and is 5 ft. 6 in. high. It is heated to a temperature of 75 deg. Fah. by means of hot water pipes. The trays containing the seeds are placed on perforated shelves and the solution seeps downward on to them from a tank at the side of the cabinet, passing through the shelves. The work required occupies only a very short time and various crops can be grown. At the end of 10 days the green food is taken straight from the trays and fed to cattle, which eat it, roots and all, leaving no waste.

The use of cabinets of this kind may revolutionise farming. Not only would fresh fodder then be available for cattle throughout the year, but also it would be possible to rear livestock in regions where the climate is too harsh to allow sufficient green food to be grown in the ordinary manner.

Ground Mica for Wallpapers

The silvery sheen that is seen on many wallpapers is produced by very finely ground mica. Although about three-quarters of the world's supply of this mineral comes from the British Empire, chiefly from India and Canada, manufacturers in England hitherto have been unable to grind it to the necessary fineness without destroying its sheen. Consequently they have had to import supplies of the ground material from America, where the process has been kept a close secret. This American monopoly has recently been ended, for an engineer who has spent many years in the Indian mica mines has discovered a satisfactory grinding process. Tests of the process have proved successful, and grinding plants are now in operation at Timperley, Cheshire, with the result that imports of ground mica have ceased and a small export trade has commenced.

Mica is found as small glittering scales in granite and other rocks, and also in the form of crystals that can be separated into transparent sheets thinner than the thinnest tissue paper. Apart from its special use in giving a sheen to wallpaper, it is of the greatest value as an insulator in electrical machinery and apparatus.

Electric Fencing

An interesting type of guard fencing has recently been introduced in some parts of America for keeping cattle within appropriate boundaries. These fences consist of a single wire that is electrified. The wire is not continuously alive, but is given occasional impulses of high voltage and low current value, which give animals in contact with the wire sharp, prickling shocks that do not harm them. Farmers using this type of fence say that the cattle soon learn to keep off the wires even when tempted with offers of food from the other side of the fence.

Light Without Heat

A new type of glass recently produced in a Czecho-Slovakian glassworks allows light to pass through it, but is not penetrated by the heating rays of the Sun. The glass is pale bluish-green in colour and will prove very valuable if the tests to which it is now being subjected are successful. It will be useful in a casing for delicate instruments that are affected by minute changes of temperature, and it will be in great demand also to replace ordinary glass in buildings and food stores in hot countries.

The discovery of this glass passing only what can be described as "cold light" is of special interest to scientists throughout the world, who so far have been unable to solve the problem of producing light without heat. The most perfect example in nature of such "cold light," is that produced by the fire-fly. It has an illuminating efficiency far greater than that of most modern electric lamps.

The Midnight Sun

The upper photograph on this page shows the successive positions of the Sun at intervals of 20 minutes during a night spent at Great Bear Lake, in N.W. Canada. The first of the nine exposures was made at 10.40 p.m., and the last taken, at 1.20 in the morning, is that on the extreme right. The central image shows the Sun's position at midnight.

It is only within the Arctic or Antarctic Circles that the midnight Sun can be seen. Great Bear Lake is on the Arctic Circle. At midsummer the tilt of the Earth points its North Pole towards the Sun, which remains visible throughout the night if the weather is not cloudy. The Sun then describes through the sky a course that is roughly oval. At points farther north there are long periods during which the Sun does not set. Thus at Hammerfest, in Norway, there is no sunset from the middle of May to the end of July. As if in compensation, there is an equally long period in winter, from November to January, when there is no sunrise.



The midnight Sun on the Arctic Circle at Great Bear Lake, in North Western Canada. Photograph by courtesy of the "Compressed Air Magazine."

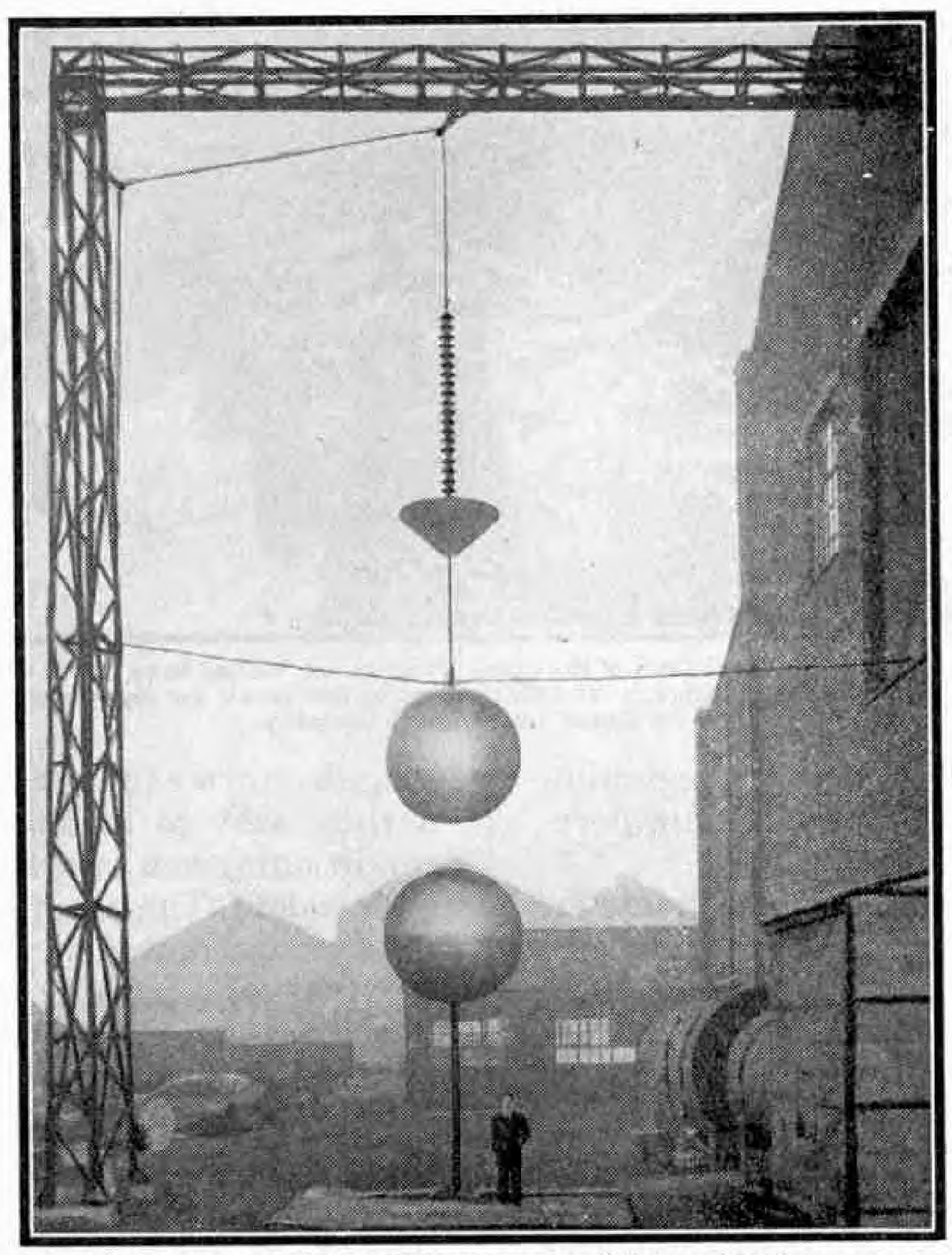
Clothes Made from Strange Materials

Seaweed recently has been used in producing fabrics that are said to be cheaper than those made from the more usual sources. These fabrics are claimed to be more durable than leather, and they can be made rot-proof and fire-proof. The details of the process so far have been kept secret. A factory is shortly to be opened at Gravesend in which the seaweed will be transformed into thin pliable "leather" for clothes and upholstery, boots and shoes, linoleum and flooring.

Seaweed is not the only unusual material that has been suggested for this purpose. It is possible that in the near future suits and dresses will be manufactured from glass, which can be drawn out under great pressure into long strands that can be spun into textile form. Many uses have already been found for this new fabric. Tape made from it has proved of great strength, and as glass is a poor conductor of electricity, the tape is of special value as an insulating material. Glass can also be woven with silk, wool and cotton into curtains and sheets that not only wear exceedingly well, but are also of fine quality and practically fire-proof.

Measuring Very High Voltages

The lower illustration on this page shows two large aluminium spheres used by the Metropolitan Vickers Electrical Co. Ltd. for the purpose of measuring very high voltages. This can only be done satisfactorily by finding the distance that a spark of the voltage under measurement will jump across an air gap, for the wires of an ordinary measuring instrument would be melted by the heat developed if a current of the voltages measured were passed through them.



Aluminium spheres for high voltage discharges. They are used for measuring voltages up to 2,200,000, and are 6 ft. 7 in. in diameter. Photograph by courtesy of Metropolitan-Vickers Electrical Co. Ltd.

The width of the air gap used in measurements of this kind should be not more than three-quarters of the diameter of the spheres, and thus the higher the voltage to be measured, the larger must be the spheres. Those illustrated are intended to measure accurately voltages up to 2,200,000, and are 6 ft. 7 in. in diameter. Each was made of four sheets of aluminium, .128 in. thick, which were beaten to shape and welded together. The spheres are polished, and discharges of electricity between them form streaks of artificial lightning.

Photographing a Library

In the "*M.M.*" for June I gave a brief account of the reproduction of books on micro-films. A page of a book can be photographed on a film that occupies only one two-thousandth of the area of the original, so that miniatures of the contents of an entire shelf of books can be packed away in a tin of 5 in. diameter. The officials of the British Museum are now making use of the micro-film to reproduce some of the rare books and manuscripts its library contains. Formerly these could only be seen in London, but now a student in a distant part of the world can obtain facsimile reproductions at comparatively little expense.

The book of which a micro-film is to be made is laid on a glass-topped table beneath the camera to be photographed. In one hour 200 pages can be recorded in a space of 6 ft. at the cost of about 35/–, but the cost is higher if the pages of the manuscript are of different sizes, or if a panchromatic film is required.

At present the British Museum makes an average of 40 book films a month, chiefly for despatch to America.

A Natural Refrigerator

The province of Anadyr, in north-eastern Siberia, is one of the coldest places on Earth, for in mid-winter the thermometer sometimes falls more than 60 deg. F. below freezing point. Yet the people who dwell in the coastal regions of the province have had to deal with the problem of cold storage!

Their difficulty arises during the short summer, when for a few months the climate is fine and warm. The waters of the Gulf of Anadyr then contain abundant fish, which could be caught in quantities large enough to last throughout the year. It was formerly impossible to use the full catch for food, however, as there was no means of preserving it until the cold days of winter, and the erection of refrigerating works were far too expensive.

The difficulty was finally solved by using the ground itself as a refrigerator. The heat of the summer sun does not penetrate more than 12 inches into the earth and the sub-soil is permanently frozen with a constant temperature below 27 deg. F. The surplus catch of fish is now kept in closed metal containers stored in underground chambers that prove quite as good as artificial refrigerators.

Life Belt that keeps its Wearer Warm

A novel pneumatic life belt has recently been introduced by an Italian. The belt weighs very little, and can easily be slipped on and fastened round the waist. The air cushions of which it is composed are rapidly inflated by blowing into the connection, but even before this is done it will float in the water, for it is made of buoyant material. If the person wearing it is too exhausted to swim, the belt enables him to keep in a horizontal position, while a further advantage is that it is luminous at night and so facilitates rescue work. It also affords its wearer protection against cold and exhaustion. A device in it radiates heat for a considerable time, and easily accessible waterproof pockets contain a stimulant and food. Tests have shown that the wearer is able to endure exposure in the sea for a far longer period than with the ordinary life-belt.

The Grand Union Canal

Linking the Thames with the Midlands

MOST of the canals in England were constructed during the last half of the 18th and the early years of the 19th century. At that time it was impossible to cope with the country's rapidly expanding commerce by means of road transport, and bulky commodities, fuels and raw materials for use in the growing factories of the new industrial towns could be conveyed by water far more cheaply and easily. The result was that by 1830 England was covered with a network of inland waterways.

The prosperity of the canals did not last long, however. Traffic on them was not very speedy, and delay was caused by the necessity for passing through the locks that connected sections at different levels. The locks were narrow, and there were few stretches of waterway over which barges with a beam of over 7 ft. could be drawn for any distance. In addition the spread of railways over the country in the years following the success of the Liverpool and Manchester line built by George Stephenson brought a new and formidable competitor on the scene, for goods could be carried far more speedily by rail than by canal. Many canals then were allowed to fall into a state of disrepair and the volume of traffic on the others hardly justified their upkeep, so that by the beginning of the 20th century they occupied a relatively unimportant place in England's transport system.



Canal craft in the Regent's Canal Dock of the Grand Union Canal, waiting to be loaded with iron and steel overside from ships from Belgium. The illustrations to this article are reproduced by courtesy of the Grand Union Canal Company.

Yet even in modern conditions canals can play an important part in meeting the requirements of industry. For the carriage of certain types of goods they have definite advantages. A canal boat has a greater capacity than a railway truck or motor lorry, and the risk of damage to goods during transit is reduced to a minimum. In addition transport by water is considerably cheaper than road or rail conveyance. Thus waterways have never lost their usefulness, and to-day there are many splendid canal systems in Great Britain and in continental countries, particularly France, Germany, Holland and Belgium. These owe their importance to the constant efforts to improve them by widening, the building of better locks and the speeding up of traffic by the use of tugs. In Great Britain there are at present more than 2,400 miles of canals, but some of them are of little value for traffic.

One of the inland waterways of this country that has been mechanised and brought thoroughly up to date is the Grand Union Canal. This consists of 11 canals that formerly were separately owned. Eight of these were amalgamated in January, 1929, and the others were acquired three years later. They include the Grand Junction Canal and other waterways in the Midlands that were constructed in the closing years of the 18th century, together with the Loughborough Navigation and the Erewash Canal, which originated in 1776 and 1777 respectively.

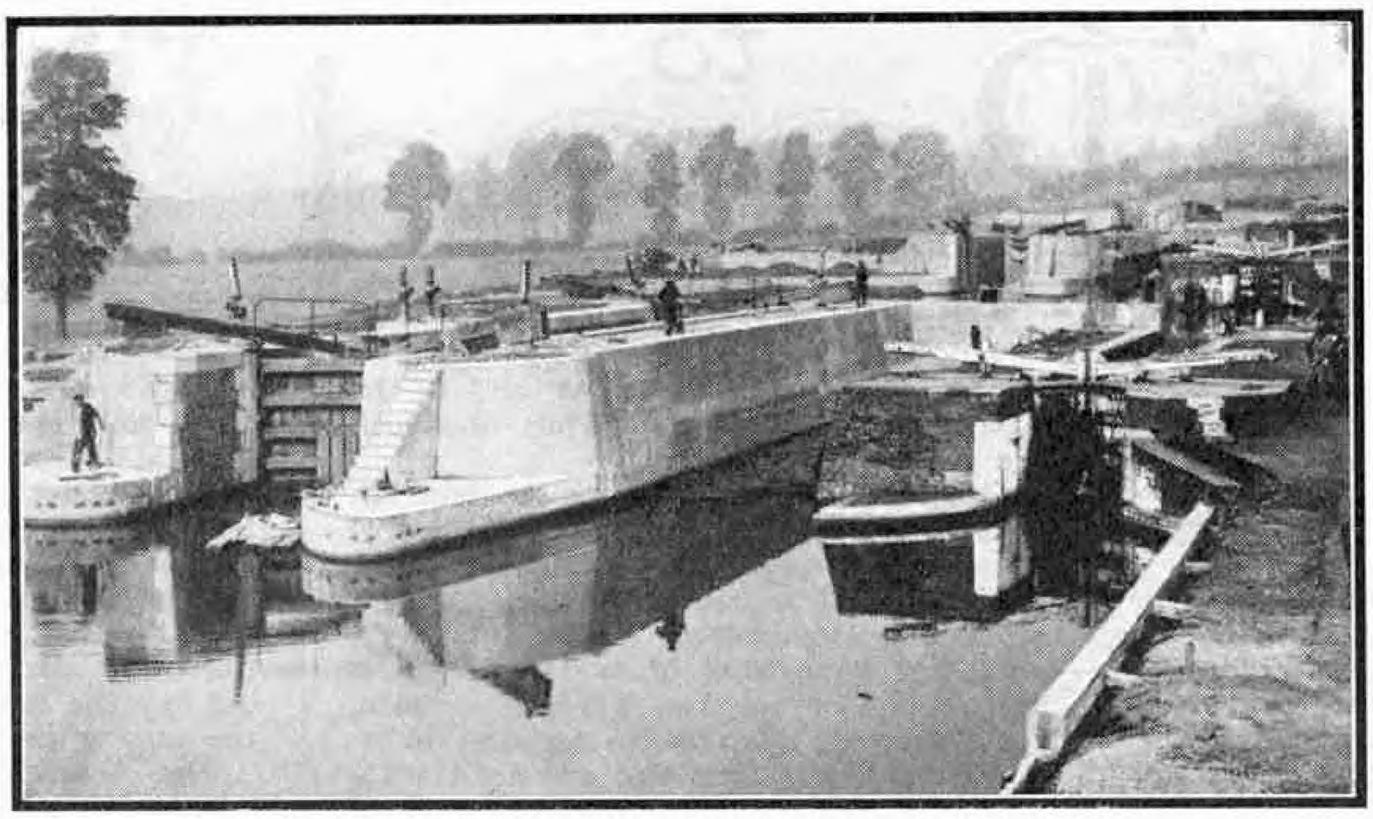
One of the constituents of the waterway is the Regent's Canal, which provides the link with the dock system of the Port of London, and the combination provides a splendid waterway from the Thames to Birmingham, with an arm reaching up through Leicester and Loughborough to the Trent Valley. Branches connect Slough, Aylesbury, Northampton, Market Harborough, and other important towns with the main waterway, and the great chain of canals also is linked up with the waterways of the north. Its length is 280 miles, and the Company controls altogether over 300 miles of waterways.

The promoters of the Union realised the necessity for making long-distance carriage by water far cheaper and speedier if they were to make their undertaking successful. Reconditioning works costing over £1,000,000 therefore were undertaken. The canal was widened in many places, locks were reconstructed, new bridges were erected and old ones repaired. The purpose of these vast changes was to make the waterway capable of accommodating an almost unlimited number of craft, and efforts were made to speed up traffic by encouraging boat owners to discard the old type of barge in favour of motor-driven vessels.

From an engineering point of view the most interesting part of the work was carried out on the Warwick Section of the waterway, extending from Braunston through Leamington, to Birmingham. In that Section there were 52 locks which had remained unchanged since their construction at the beginning of the 19th century. They were of the narrow type, and impassable for boats with a width of more than 7 ft. Larger craft working on the Regent's and other sections of the canal could not go through them to Birmingham, and they formed a bottle-neck in the heart of the Midlands that seriously hindered traffic. The

company therefore planned to double their size, and nearly half the total expenditure on reconditioning was spent in enlarging them.

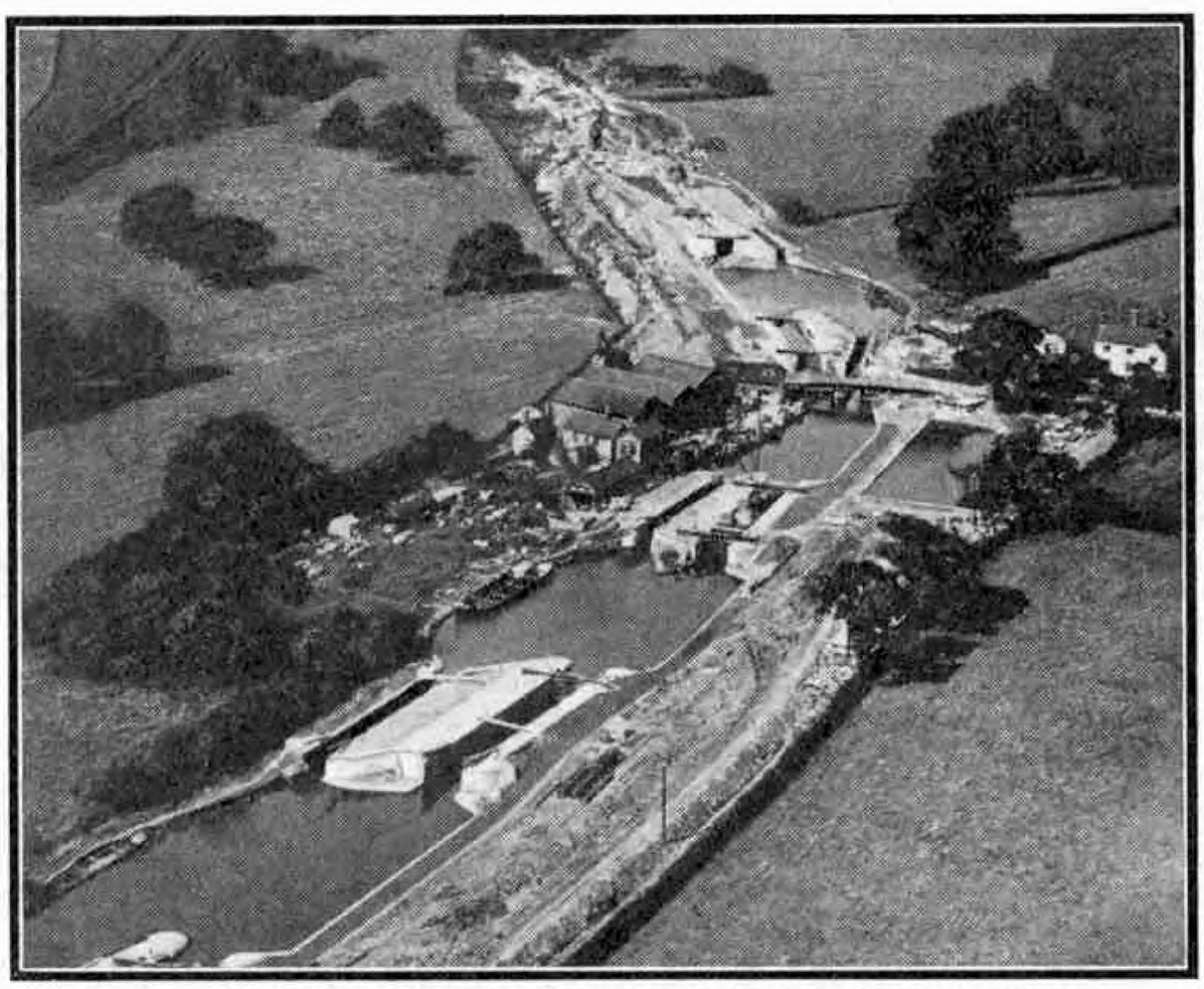
The scheme of improvement was begun in 1931 and is now complete. About 1,000 men were engaged in the task. Many of these are still active in other sections, for the aim of the Company is to improve the canal still further, so that it will easily accommodate throughout craft with a 14 ft. beam and a correspondingly larger carrying capacity.



The new locks of the Grand Union Canal at Knowle, in Warwickshire.

This development of the waterway itself has been accompanied by even more striking changes in the vessels to be seen on it. Barges drawn by horses plodding steadily along the towpath are too slow for modern conditions, and have given way to new and larger craft fitted with Diesel engines that move more speedily. The Grand Union Canal Carrying Company, a subsidiary formed shortly after the initial work of reconstruction had been completed, now operates the largest fleet of boats on the waterway. This fleet consists of 185 pairs of Diesel-engined canal craft of a type evolved after six years' experiment in design. The first of each pair is a motor boat, the second being what is called a butty, hauled by the first.

The engines of these boats are of 18 to 20 h.p. and give them a speed of nearly six knots when fully loaded. The vessels themselves have a cubic capacity of about 2,800 cu. ft. below gunwales, and therefore have ample room for the carriage of general cargo, which is fully protected from the weather by tarpaulins. Their draught is 4 ft. 3 in., and when the company's extensive dredging programme is completed it will be possible to load the maximum tonnage throughout the whole length of the waterway. The cabins are fitted with electric light, and each boat has a powerful searchlight so that there is no difficulty in passing through the locks at night.



An aerial view of a flight of locks on the Warwick Section of the Canal.

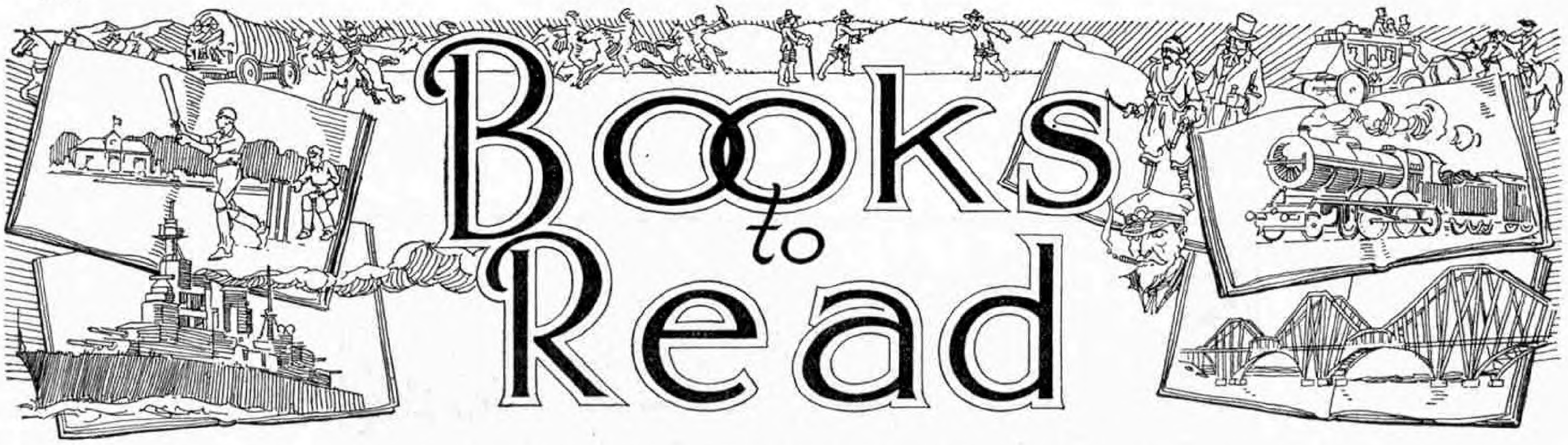
Trials also have been made of a motor boat 75 ft. in length that is fitted with a 30 h.p. Diesel engine. This has a beam of 12 ft. 6 in. and with a load of 66 tons its draught is 4 ft. 6 in. It is capable of navigating on the Thames as well as the canal.

Canal facilities have been improved also in other ways. Wharves and warehouses have been provided at most of the important places served by the waterway. These are fitted with the most up-to-date equipment so that the goods can be handled with the greatest speed. In the Islington district of London the canal passes through a tunnel 960 yds. in length, and there tugs are stationed to haul those craft that cannot proceed under their own power. These tugs haul six loaded barges at a time through the tunnel. As a result of these and other changes a trip from London to Birmingham can now be made in 60 hours, which represents a saving of over 2½ days on the shortest time required for the journey before the Grand Union Company was formed.

In London the main line of the Canal terminates on the Thames at Brentford, but the Regent's Canal gives direct access to the London dock system. This section ends at Regent's Canal Dock at Limehouse, on the north side of the Thames. This is an integral part of the Port of London, but is owned and controlled by the Grand Union Canal Company. Ships from overseas reach it through a lock entrance 350 ft. long and 60 ft. wide. It has a water space of 11 acres and can accommodate vessels of 2,000 tons at either the quays or the buoys. Boats capable of receiving goods over ships' sides are used, and an importer can charter his own vessel to cross the seas, bring it directly into Regent's Canal Dock, and tranship its cargo to canal craft that will deliver it at any suitable point along the waterway.

Coal also is handled in large quantities on the canal. There is a 205 ft. jetty in the Dock, where coal-carrying steamers from the north east coast are unloaded by means of two powerful grabs, each capable of lifting six tons. Unloading takes only about 10 hrs. It is carried out by night as well as by day, and it is not unusual for a vessel to enter the Dock on one tide and to leave for the return voyage on the next.

The Grand Union Canal Company have just completed negotiations that have resulted in the establishment of a new all-water transport service between this country and the Continent. The first vessel of the new line, which is to be called the Regent's Line, sailed from Antwerp to the Regent's Canal Dock on 4th September, and there are to be two sailings weekly from Antwerp and London.



Here we review books of interest and of use to readers of the "M.M." We can supply copies of these books to readers who cannot obtain them through the usual channels. Order from Book Dept., Meccano Limited, Binns Road, Liverpool 13, adding 1/- for postage to the price. Postage on different books varies, but any balance remaining will be refunded.

"The Boys' Book of the Sea"

By CHARLES BOFF. (Routledge. 6/- net)

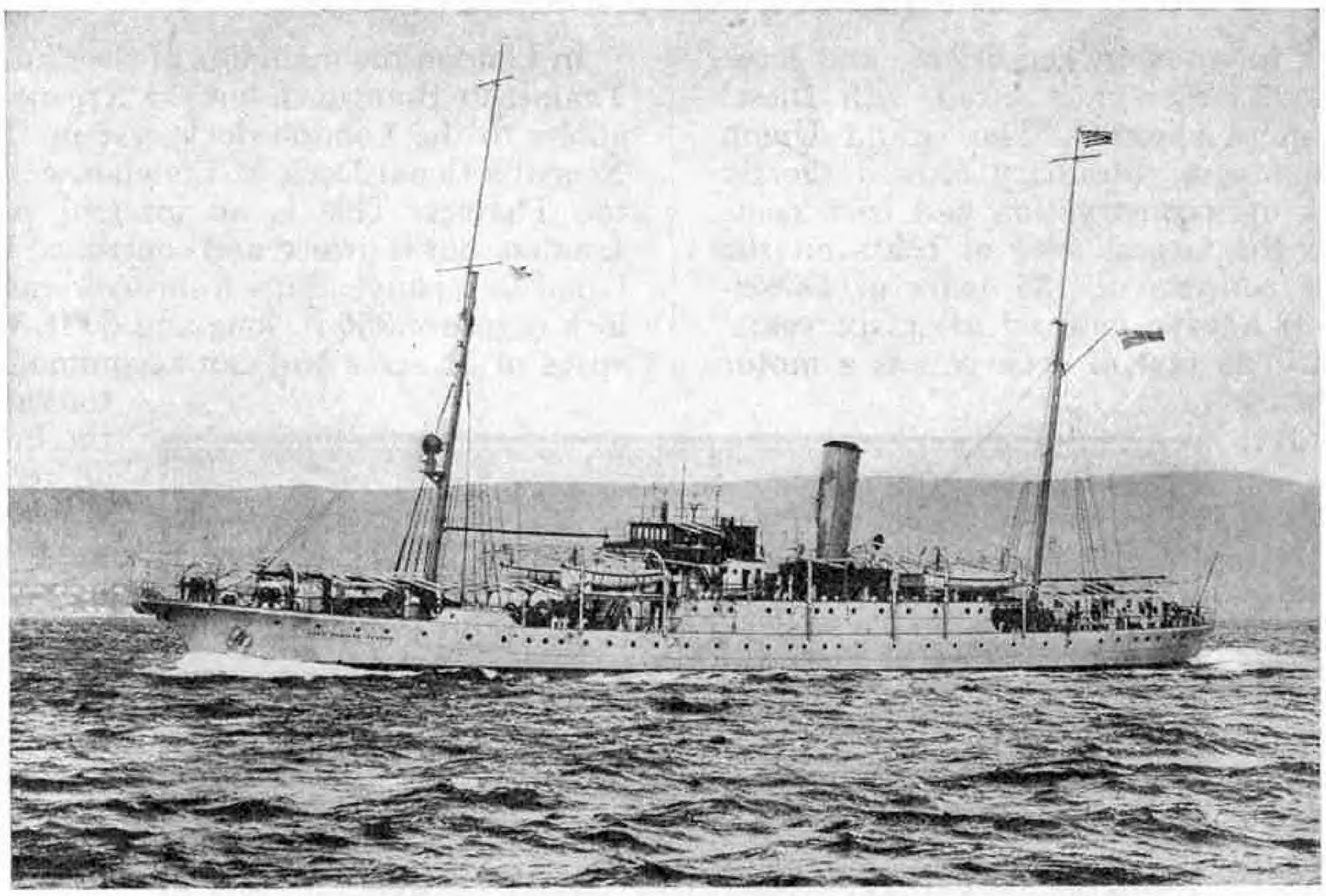
This book will be of absorbing interest to young and old alike. In it are stories of great achievements and adventures, and of the romance and tragedy of the sea, that will enthral the reader from the first page to the last. It is packed with information on a variety of topics connected with the sea and ships, and there is not a dull passage in its pages.

Mr. Boff begins with a chapter on the struggle for the "Blue Riband" of the Atlantic, in which he describes such great vessels as the *"Mauretania,"* the *"Rex,"* and *"Bremen,"* and the more recent *"Queen Mary"* and *"Normandie."* Then follows a section dealing with the work of the diver, the dangers that constantly threaten him, and the precautions taken to ensure his safety. Descriptions are given of the Davis Submerged Decompression Chamber, which in deep-sea operations is suspended 60 ft. below the diving vessel; and of the latest all-metal diving dress, weighing about 800 lb., with which depths of over 1,000 ft. are said to be possible.

In contrast to this chapter is a thrilling section dealing with great disasters of the sea. These include the sinking of the *"Lusitania,"* and the wonderful open boat voyage of the men of the *"Trevessa,"* who endured 23 days of incredible hardships as they slowly and painfully made their way over 1,500 miles of ocean to the island of Mauritius. A more recent drama of the sea included in this chapter is the gallant rescue early this year of the crew of the Norwegian freighter *"Trym"* by the British motor-ship *"Venus."*

The ships of the Royal Navy are dealt with in three absorbing sections describing the ships themselves and their equipment. Special attention is paid to the destroyers, the fastest ships of the Fleet, and to the submarines, the special duties of which are vividly explained.

Other chapters describe the construction of a great ocean liner and the wonders of the modern dockyard. A fascinating account is given of the salvage of the German fleet scuttled at Scapa Flow after the Great War; while the adventures of modern treasure-seekers, queer cargoes, life-boat rescues, the laying of deep-sea cables and lighthouses and lightships also are dealt with.



The "Lady Denison Pender," a modern cable-laying vessel owned by Cable and Wireless Ltd. This illustration, and the upper one on the opposite page, are from "The Boys' Book of the Sea," reviewed on this page.

The book is exceptionally well illustrated with 31 photographic plates and four showing distinctive marks of rank in the Navy and the Merchant Service.

"A Dog at His Heel"

By CHARLES J. FINGER. (Harrap. 8/6 net)

An adventure story that is to arouse the greatest interest must have in it a sense of reality, and here is one by an author who is thoroughly familiar with the countries in which the scene of his story is laid, and with the kind of people about whom he writes. It deals with episodes in the lives of a friendly and daring crowd of young fellows, and more particularly with the story of Jock, an Australian sheepdog, who wanders far from his own country and takes part in a great sheep drive in Patagonia.

Jock makes his appearance in the shearing shed of a Western Australian sheep station, and a great shearing contest for his possession follows between Bill Bond and Long Charlie, both of whom claimed to have been his finder. Interest in the contest grows to fever pitch among the men in the camp. By strict count Long Charlie is the winner, but generous arithmetic and allowances for bad luck lead him to give Jock to Bill, who deliberately accepts an uncongenial job out on the sheep runs in order to give the pup a thorough training.

The Australian scenes that follow are very attractive indeed. Jock proves himself to be possessed of the true sheep instinct, but somehow he manages to get his master into a rough and tumble ring fight with the champion of Western Australia, which Bill wins.

Jock and his master then take a flock of rams to South America, in order to drive them southward to begin a new industry in Patagonia. In the Argentine a new set of adventures begins, in which Patagonian Indians and gauchos are met with, while shipwreck and the attentions of bandits add to the fun. Jock and his master thoroughly enjoy every episode that occurs during their drive, but they keep their minds steadily on their work, and in the end win safely through. Jock in particular distinguishes himself, on one occasion finding and herding up a straying part of the flock and bringing it back to the main body. Eventually the flock is safely guided to the new ranch in the extreme south of the continent, and there Bill and his dog are reunited with their old friend Long Charlie, who has helped to prepare the new home for them.

Every reader will love Jock and will long for a dog of his calibre for himself. Bill Bond and Long Charlie are rough, but simple and good hearted, and nobody could wish for anything better than to follow them in Western Australia and in South America, reading their minds with the author and admiring their resource and courage. The book is illustrated by 15 excellent drawings by Henry C. Pitz, six of which are double page.

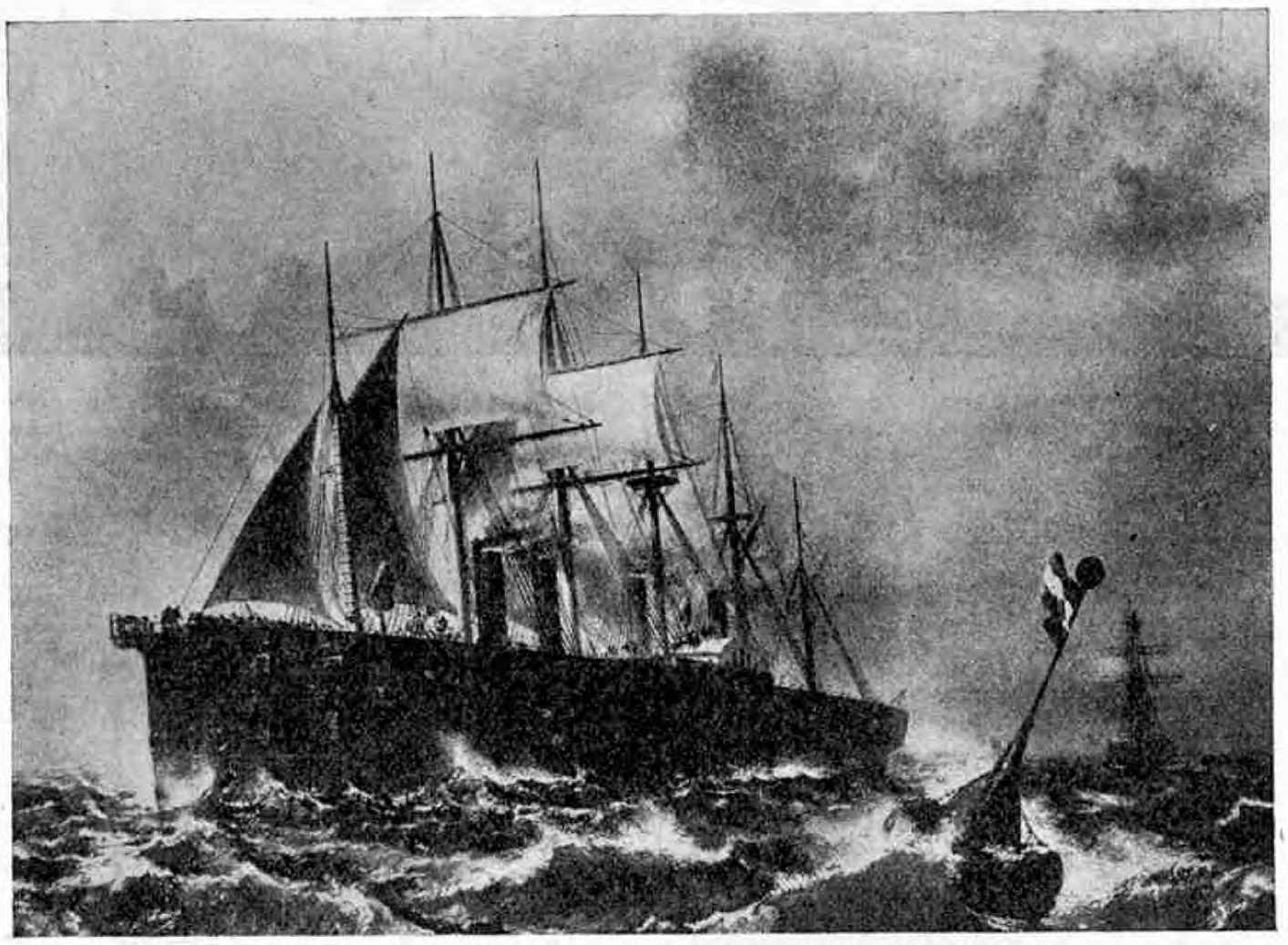
"The Balkans by Bicycle"

By W. P. Hamsher. (R. Witherby. 8/6 net)

The best way to see a country and to learn the ways of its inhabitants is to walk or cycle leisurely through it; Mr. Hamsher explored the Balkans by the second of these methods. His tour began at Vienna and led him through Yugoslavia, Albania and Greece to Salonica and Constantinople. Thus he passed in a few weeks from modern Western cities to the mosques and minarets of the East, taking in his path the countries that for centuries have been fighting grounds of Turk and Christian, and where the two religions and cultures still remain almost inextricably mixed.

The author had no particularly exciting adventures, but his story is of great interest throughout. Whether he was dealing with officials or tourists like himself, with towndwellers or peasants, he was always thoroughly at home, and his stories of the people he met give a remarkably vivid idea of the life of the places he visited. These included Sarajevo, where the Archduke Ferdinand was assassinated in 1914, an event that led to the outbreak of the Great War. After visiting the ports along the shore of Dalmatia, he climbed the mountains of Montenegro, once a romantic little kingdom that kept the Turks at bay. He then made his way through comparatively undeveloped regions in Albania, where he took part in the country's first census and witnessed a dervish dance.

When the author reached Greece and Salonica, he made a special journey by sea to Mount Athos, the Holy Mountain on the Aegean Sea that for centuries has been the abode of none but monks; He climbed to the summit of the Holy Mountain in order to see the Sun rise, lived in the monasteries and talked with the monks; and the sections in which he describes his stay on the peak are among the most interesting in the entire book. There are 16 full page photographic illustrations and a map showing the author's route.



The "Great Eastern," the vessel that in 1866 laid the first Atlantic cable.

"Timber Sahib"

By Robert Harding
(Boy's Own Paper Office. 2/6 net)

Timber Sahib, known by friend and foe alike as "The Watcher of the Hills," was India's greatest secret service agent. In disguise he penetrated far into border territory, risking discovery and death at any moment in order to discover news of plots or of projected risings. Sometimes he was on the track of gun-runners or bandits; at others he was searching out spies in the peaceful cities of India itself. He always succeeded in his plans, however, and became the terror of plotters and evil doers of all kinds.

Readers will thoroughly enjoy Mr. Harding's splendid tales of Timber's exploits, revelling in his splendid fights with giant tribesmen, and appreciating the skill with which he and his chosen band of watchers unravel the secrets of robbers and rebels alike. Every page has its thrill, as Timber turns the tables upon enemies in spite of all difficulties, and the high standard is fully maintained throughout the 15 tales contained in the book.

"The Mystery of Beeston Manor"

By Lionel Surrey. (Harrap. 3/6 net)

A story in which Scouts play the part of detectives is bound to be exciting, and *"The Mystery of Beeston Manor"* fully lives up to expectations. The members of the troop concerned are fortunate in having an ex-detective as Scoutmaster, and he encourages them to specialise in detection, with the result that they follow up small clues and solve mysteries that have baffled the police. Other adventures follow, including thrilling flights in the troop aeroplane while investigating the disappearance of an ex-convict and the death of a man at a level crossing, together with exciting happenings at the docks and in an empty mansion. There is a coloured frontispiece and four other full page illustrations.



A monastery on Mount Athos. From "The Balkans by Bicycle," reviewed on this page.

"Modern Woodwork and Furniture Making"

By G. H. Barker, M.Coll.H.
(Technical Press Ltd. 7/6 net)

The purpose of this book is to place before its readers the general principles of woodwork design, and their application to sound jobs that boys and students can make. Mr. Barker is an expert craftsman, and writes with real enthusiasm as well as the practical knowledge of a successful teacher of his subject.

The book is divided into two parts. In the first Mr. Barker discusses modern developments in handicraft, the most suitable materials for various types of work and the different methods of designing and decorating models. In the second part he explains how to make useful articles ranging from such things as a cigarette box and an oak tea-tray to a music cabinet, a writing desk and other more advanced and complicated models. There are eight full page plates and 58 useful working drawings in the text for the guidance of the constructor.

"California Holiday"

By Doris Escourt. (Harrap. 5/- net)

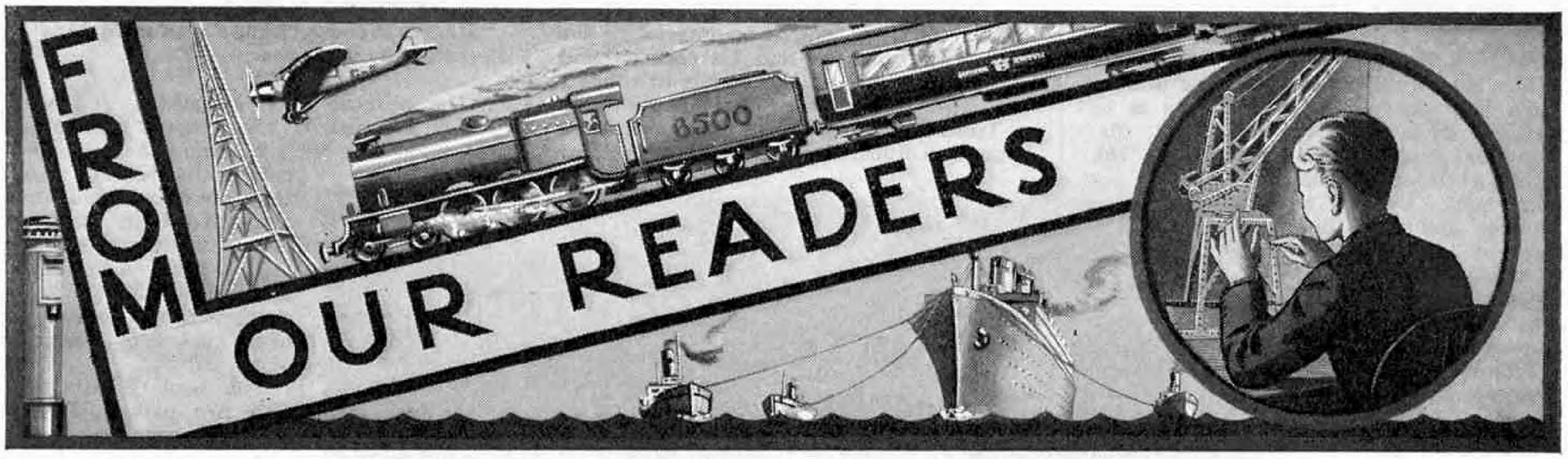
The adventures of an English boy and girl with three American companions during a camping trip in the Sierras of California are told in this attractive story. They have really exciting times in the forests of the high country through which they pass. On one occasion an accident to a pack animal results in the loss of half their supplies when they are in a remote valley. A forest fire then breaks out, and the English children are cut off by the flames when going for help, and are rescued only just in time. Throughout they are troubled by a stranger who seems to be following them, but is never seen. Eventually the mystery is happily solved, but not before other events have helped to make their holiday thoroughly unusual and interesting.

The book has a coloured frontispiece and four full page illustrations, together with a map of the wanderings of the party.

"Things to Make in the Club Room"

By H. Bramford
(Brown, Son and Ferguson Ltd. 1/6 net)

Mr. Bramford's book is intended chiefly for Scouts, but also will be useful to officials and members of all clubs in which a hobbies section is organised. The range of subjects dealt with is very large. Readers are shown how to make material for various table games, toys and tricks, and given guidance in book binding, printing, woodwork and leathercraft. The articles constructed in accordance with the directions in the book are simple, but useful and effective and good working drawings are included as illustrations.



These pages are reserved for articles from our readers. Contributions not exceeding 500 words in length are invited on any subject of which the writer has special knowledge or experience. These should be written neatly on one side of the paper only, and should be accompanied if possible by original photographs for use as illustrations. Articles published will be paid for. Statements in articles submitted are accepted as being sent in good faith, but the Editor takes no responsibility for their accuracy.

Life on a South Sea Island

A short time ago I stayed several months on Rarotonga, one of the most beautiful islands in the Pacific. It is part of the Cook Islands, which lie about 2,000 miles north-east of New Zealand, and is rich in vegetation, with palm trees on the beach and shrubs and flowers on the rugged volcanic hills of which it consists. I soon discovered that the brown-skinned natives of Rarotonga are as pleasant as their homeland. They belong to the Polynesian race, and are of fine physique and erect carriage.



An animated scene at Mauke, in the Cook Islands. Surf boats carrying boxes of oranges across the reef to the waiting steamer. Photograph by L. Franzman, Christchurch, N.Z.

The island is surrounded by a lagoon, about half a mile wide, in which I had great fun bathing, canoeing and sailing outriggers. An outrigger consists of a canoe, usually a hollowed-out tree trunk, with a wooden float extended 2 ft. or more from the boat's side by means of two pieces of wood. This float prevents the boat from capsizing in rough waters. A sail is provided, and when afloat the craft requires careful handling.

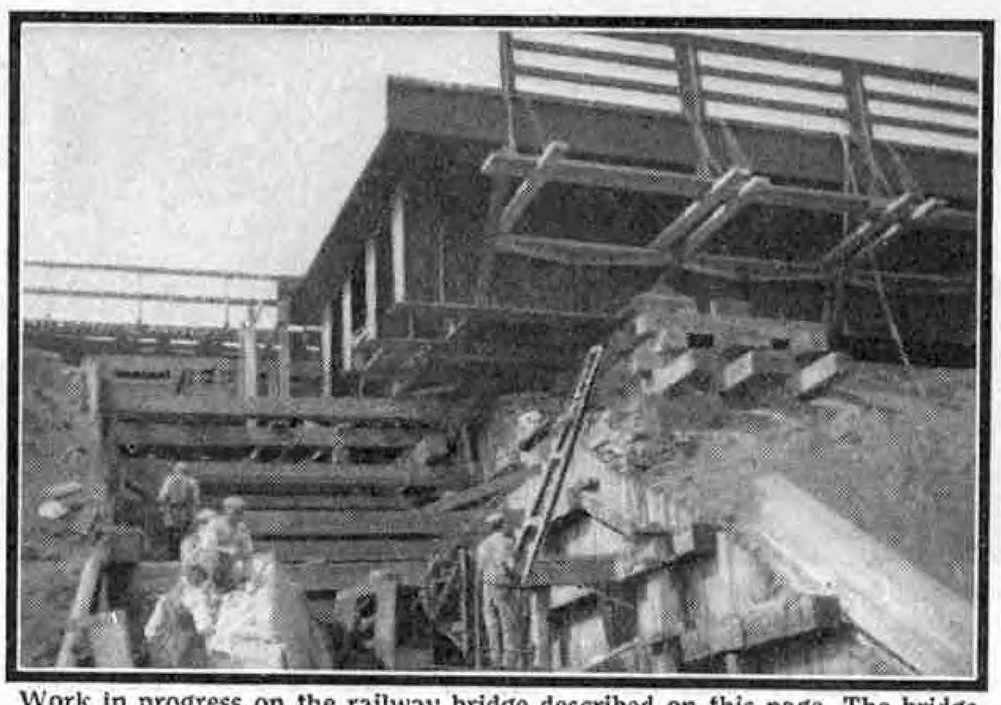
The Rarotongans grow most of the food they need on the island, besides producing oranges, copra, bananas and tomatoes for export. Trading schooners call regularly at the various islands of the Cook group to pick up these products, and on several occasions I travelled in a schooner to other islands. At some of these the reef adjoins the island, there being no lagoon, and landing there is often exciting. A surf-boat is used, and this "shoots" the reef in a smother of spray. These boats are also used for loading produce on to steamers. At Mauke one day I saw several boats laden with oranges overturned by the surf, and many were holed on the reef.

L. Franzman (Christchurch).

Building a Railway Bridge

In many districts ring roads are being constructed to allow traffic to pass from one side of a town to the other on first-class highways without using the busy city thoroughfares. In the making of the Leeds ring road, the L.N.E.R. line from Leeds to the north was found to cross its designed path. The railway at this point is on a high embankment, and it was decided to cut the road through this.

The contract was undertaken by the Cleveland Bridge and Engineering Co., of Darlington. Work commenced in November 1935, when traffic was diverted one week-end to allow a temporary bridge to be brought by rail and placed in position on the embankment by railway cranes. The track had previously been taken up, and was then relaid over the bridge.



Work in progress on the railway bridge described on this page. The bridge structure can be seen on the right. Photograph by H. Simpkiss, Leeds.

The next few months were spent on shoring up the embankment with large baulks of timber, digging out the earth at what would be the ends of the bridge, and erecting supporting masonry. When this was completed, several large timber trestles were placed on the embankment at the side of the temporary bridge, and the line was closed for another week-end while the final bridge structure, weighing 120 tons, was brought by rail and placed temporarily upon them, where it remained for a few weeks.

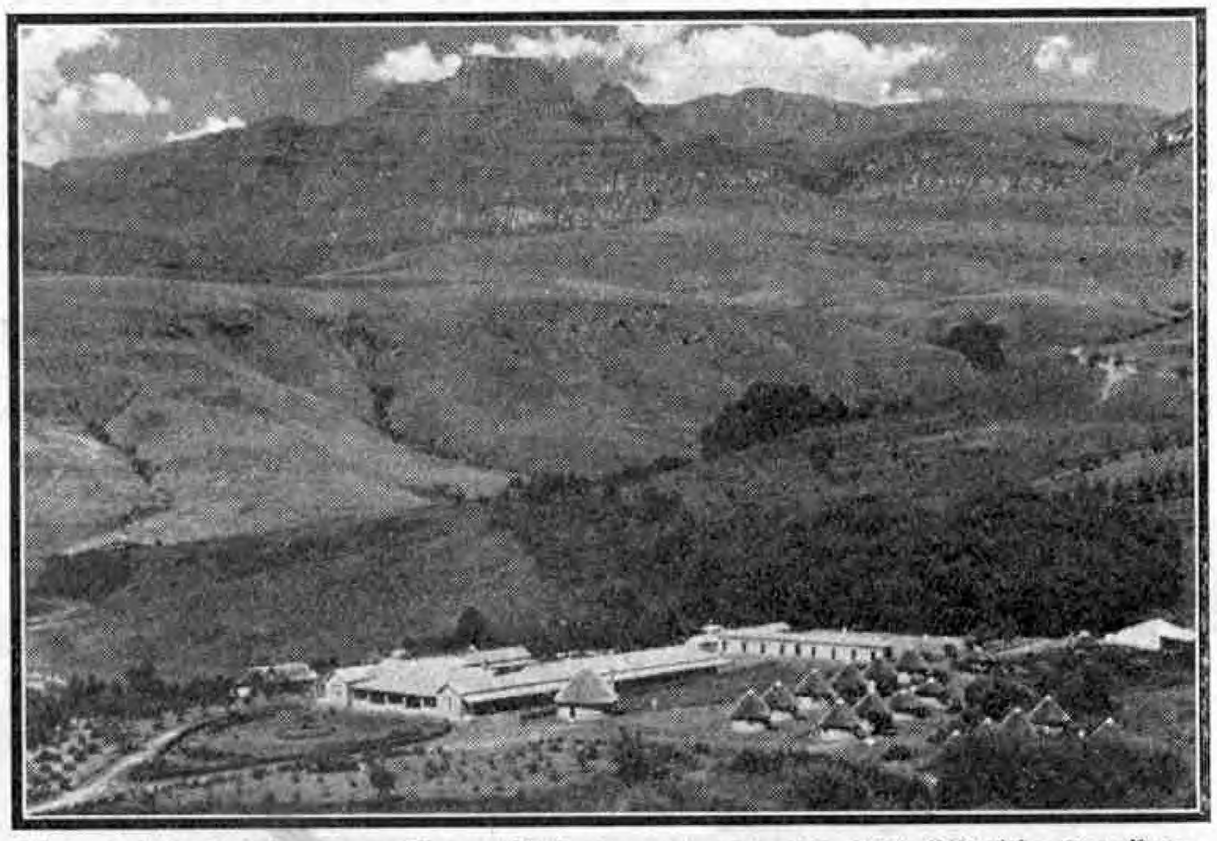
Traffic was again held up for a short time when all was ready for the transference of the bridge into its final position. The temporary bridge was lifted away in three sections and removed by rail. Then the bridge proper, running on steel ball bearings in which the balls were the size of a man's fist, was gradually slid into place.

H. Simpkiss (Leeds).

Railway Tests in Natal

Natal is a land of rolling hills, broken here and there by towering cliffs of rock. The construction of railway lines in that country therefore has been difficult, and the track passes through many tunnels and round tortuous curves, and has several steep gradients.

Special speed restrictions have to be enforced at the sharp bends, and an interesting series of tests was recently carried out in order to learn the exact speeds at which engines and laden tenders would overturn on them. These experiments took place on a test track laid down between Estcourt and Willow Grange, in northern Natal. The track includes a bend with a radius of 300 ft., which is the minimum allowed in the Union on the standard track of 3 ft. 6 in. gauge.



Characteristic Natal scenery. The undulating country presents great difficulties to railway constructional engineers. Photograph by P. Andrews, Durban, South Africa.

In the first test a tender filled with coal and water was released at the top of an incline leading to the bend and allowed to run down under its own momentum. In successive runs it started on its career from points varying from 900 ft. to 2,700 ft. from the beginning of the curve, and eventually left the rails when running at a speed of 41.7 m.p.h. The theoretical over-turning speed for such a vehicle varies from 37.5 to 45 m.p.h. according to the condition of the track. The regulation maximum speed allowed on the South African Railways on similar curves is 23 m.p.h., so that there is a wide margin of safety.

An old locomotive and loaded tender, weighing altogether 98 tons, were next coupled together and run over the test line 15 times from increasing distances before they finally overturned. On the final run the vehicles were released 3,600 ft. up the curve and attained a speed of 43.4 m.p.h. before reaching it. The check rails slowed them down slightly, but at 40 m.p.h. the tender left the rails and completely overturned, landing with its wheels in the air and dragging the locomotive off the line on to its side.

There was a tremendous noise when the monster crashed over amid a cloud of dust. The ground near the line was ploughed up and pieces of coal sent flying for a considerable distance. The tender was completely smashed up, several steel plates being buckled and two vacuum tanks wrenched off, but on the locomotive only the cab roof was damaged.

Photographs and cinematograph records were taken of the trials. These will be reproduced in slow motion for close examination. P. Andrews (Durban, S.A.)

From Castle to Lighthouse

At Fraserburgh, on the most north-easterly point of the Aberdeenshire coast, is a lighthouse of which the main tower is part of an old castle. This is the Kinnaird Head Lighthouse. It is not known when the castle was built, but it was falling into ruin in 1787, just 150 years ago, when the Northern Lighthouse Commissioners erected a lantern on the tower. The structure remained unaltered until 1903, when renovations were carried out.

The lantern on the tower is 120 ft. above high-water level, and its beam has a strength of 1,140,000 candle power. It is rotated by a mechanism of the "grandfather clock" type, in which a heavy weight suspended on a chain down the centre of the tower is "wound up" every half hour. As this "runs down" it causes the lantern to rotate. There are also a wind direction-finder and a gauge on the tower.

In a great chamber half way up the tower are stored thousands of gallons of paraffin used for the light and for the engines that generate compressed air to operate the fog-horn. This compressed air is kept in tanks at a pressure sufficient to keep the fog-horn going for 12 minutes, during which time the engines can be started and heated up. The fog-horn is situated about 50 yards nearer the sea-shore and points to the north-east. Rev. R. I. Mitchell (Lonmay, Aberdeenshire).



Kinnaird Head Lighthouse, Aberdeenshire. The tower is that of an old castle. Photograph by Rev. R. I. Mitchell, Lonmay.

Trawling in the Arctic

I recently made a trip of some 4,000 miles to the White Sea in a trawler. We sailed from Grimsby in a terrific gale, with our decks continually swept by big waves. On the fifth day out we arrived in the calm blue coastal waters of Norway, and steaming north were soon out in the Arctic Ocean. There trawling was commenced. The mouth of the net is cone-shaped, and is kept open by iron floats and two big otter-boards each weighing about half-a-ton. The complete trawl weighs about five tons.

After a couple of hours, the trawl was hauled aboard by a steam winch. The "cod" or pointed end of the net was then opened, and the catch came slithering out on to the deck. The empty trawl was lowered into the water again, while the fish caught were gutted, washed and finally sent below to the fishroom to be packed in ice. The ice carried on board for this purpose weighed 70 tons. R. A. Brown (Leeds).

In Search of New Models

Workshop Tools and Equipment

MECCANO model-building is real engineering in miniature, and in our search for subjects for new models it is natural that we should examine the possibilities provided by the machinery and equipment of a real engineering workshop. Almost every workshop and factory is a source of ideas for splendid models, and a great advantage of this kind of model-building is that a very wide range of subjects suitable for both small and large Outfits is covered.

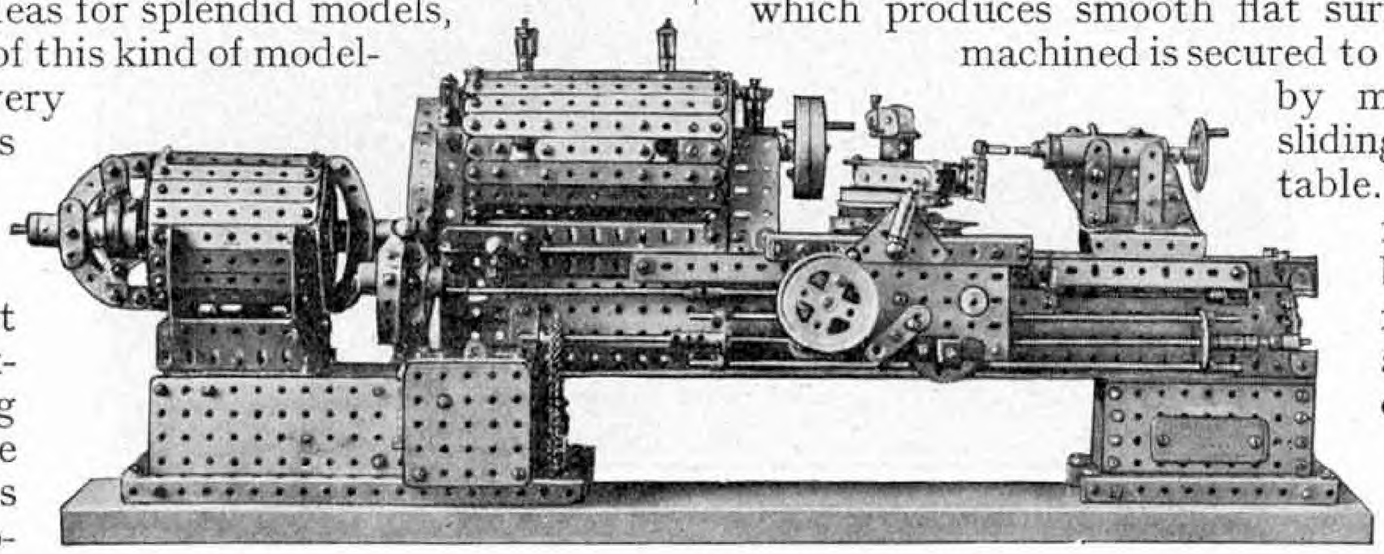


Fig. 1. A detailed model of an engineer's screw-cutting lathe. It was built by J. Ringnalda, Leeuwarden, Holland, and is equipped with a fully automatic tool rest and Electric Motor drive.

Probably the most frequently used workshop tool is the drilling machine, and there are enough varieties of this machine alone to provide interesting subjects for many pleasant hours of model-building. Drilling appliances range from small hand-operated tools and portable machines to giants capable of drilling holes 6 in. or more in diameter through many inches of steel plate.

The model shown in Fig. 2 on this page represents one of the small hand drills used in many workshops for rapidly drilling holes up to about $\frac{3}{4}$ in. in diameter. It is operated by an electric motor housed inside the casing and suitably geared to the shaft of the drill chuck. A model of one of the smaller types of drilling machines is illustrated and described on page 614 of this issue. This will be found a good subject for those whose stock of parts is small. It is driven by a "*Magic*" Motor, which is a power unit particularly suitable for incorporating in miniature models such as this.

The most generally useful machine tool, and the one that has contributed most to the development of modern engineering, is the lathe. By means of this wonderful machine an enormous variety of articles can be produced, from the tiny screws used in watches to giant propeller shafts for a modern ocean liner. There are many different types. The simplest is the woodworker's lathe, and then come engineers' screw-cutting lathes. More complicated than either of these types are the wonderful automatic capstan and turret lathes. So long as these are supplied with raw material in the shape of rod or bar metal, they will continue to produce completely finished articles.

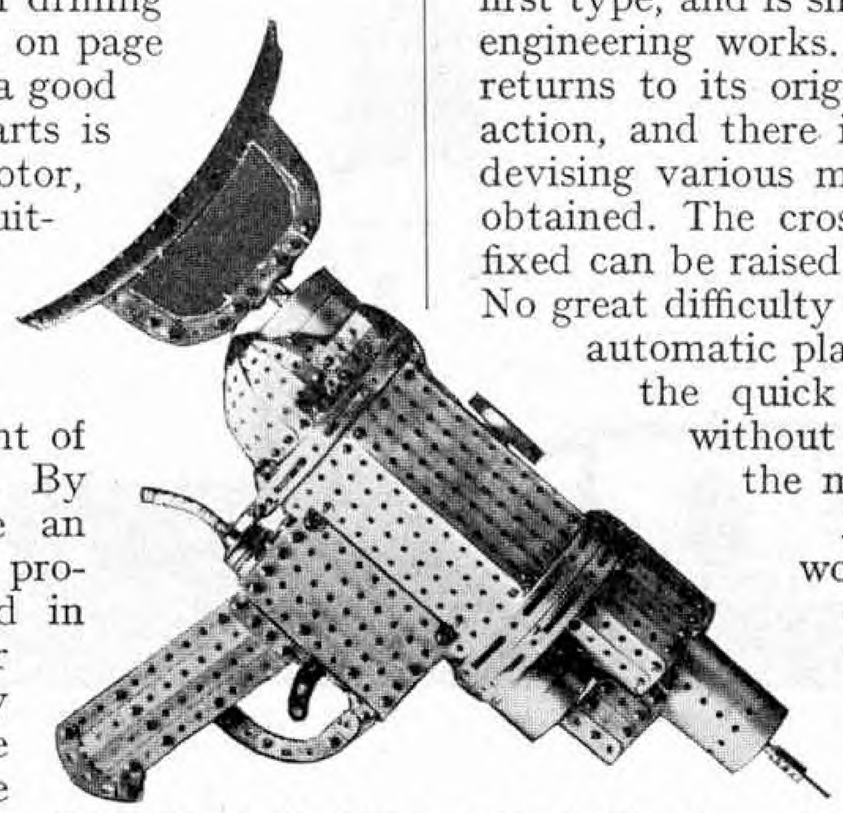


Fig. 2. This electric drilling machine is driven by a motor, and is another example of J. Ringnalda's work.

The automatic machines naturally are subjects for the larger Outfits, but good models of the simpler lathes can be constructed from even small Outfits, and can actually be used for shaping a candle or a piece of wax into various articles. A fine model of one of the larger types of lathes is shown in Fig. 1. This machine is driven by an Electric Motor geared direct to the mandrel, and is provided with screw-cutting gear and fully automatic feed to the tool saddle.

One of the most interesting machine tools is the planer, which produces smooth flat surfaces. The work to be machined is secured to a long table or "platen" by means of special bolts sliding in T-slots cut in the table. The table moves to and fro, and usually is driven by a rack and pinion movement operated by an electric motor. The cutting tools are fixed into tool holders, or "boxes," attached to a cross-piece that straddles the table, and the whole cross-piece can be lowered and adjusted so that the tools will take the right depth of cut from the metal. After each forward cutting stroke the tool holder moves across through the width of the cutting tool, and so takes a fresh cut each time the work moves toward it. There are also planing machines in which the work remains stationary while the tool moves to and fro above it, taking a fresh cut into the metal at each forward stroke.

The model shown in Fig. 3 represents a machine of the first type, and is similar to those installed in many large engineering works. After each cutting stroke the table returns to its original position with a "quick return" action, and there is plenty of scope for experiment in devising various methods by which this action can be obtained. The cross-piece to which the tool holder is fixed can be raised or lowered to alter the depth of cut. No great difficulty should be experienced in building an automatic planer of this type, and in small models the quick return device can be eliminated, without seriously affecting the realism of the model.

A planing machine used for woodworking is of a very different type. It comprises a circular cylinder, fitted with very sharp cutters. This is mounted horizontally under a slot in the work table, in such a manner that the edges of the blades protrude slightly through the slot, and is rotated at a very high speed. The extent to which the blades protrude is adjustable by means of a screw gear operated by turning a handwheel. The wood to be planed is fed over the blades by passing it beneath revolving feed rollers.

Wood and metal-cutting saws also provide plenty of scope for keen model-builders and although models of this kind cannot be put to any practical use, there is plenty of fun to be obtained in making them operate realistically. There are several different types, including circular,

band and vertical saws. The circular saw probably is the easiest to reproduce in Meccano, and a small model of one of these can be built up using a 57-teeth Gear or a Sprocket Wheel to represent the saw. In making band saws Sprocket Chain can be used for the endless flexible blade, but a better idea would be a strip of celluloid serrated on one edge to represent teeth. A vertical saw consists of one or more rigid saw blades that move up and down while the work is fed towards them, and an interesting working model of a saw of this type could be made by using Rack Strips (Part No. 110) for the saw blades.

Another type of saw with which most readers will be familiar is the fret-saw. Although these machines are not used in engineering shops, they sometimes form part of the equipment of cabinet works and similar workshops where very delicate patterned wood-cutting is done, and their movement is very interesting.

A model of a simple fret-saw is shown in Fig. 4, and will give some idea of the splendid working models of this kind that can be built. Although it is small, it is fitted with an adjustable work table, and the saw frame is complete with an efficient tensioning device. The model is driven by an Electric Motor, and is so well constructed that it is capable of cutting wood up to $\frac{3}{16}$th in. thickness. Where a Motor is not available a model of this kind could be arranged for operation either by hand or by foot pedal. The reciprocating motion can be applied to the rear of the saw arm by a Bush Wheel and a connecting strip or rod.

Boys who possess only small Outfits, but who wish to try their skill in making models of engineers' tools, cannot do better than attempt a simple grindstone. A realistic grinding wheel can be made from a disc of wood about 1″ thick and 3 in. in diameter, and a very fine effect can be obtained by gluing a strip of emery cloth around the rim of the disc. The disc can be mounted on a Rod of suitable length by means of Bush Wheels.

Apart from the actual machine plant, many really good subjects for models are to be found among the miscellaneous appliances that make up the general equipment of a works. These include, for example, such things as vices, ratchet spanners and pulley block hoisting tackle. There are dozens of different kinds of pulley blocks that can be made subjects for experiment, and this is a particularly interesting field for readers who enjoy making models of the more serious type, in which one's knowledge of mechanical principles can be exercised. A pulley hoist properly and skilfully constructed can be used for lifting considerable loads. Very few Meccano models of this kind have been built, and so here is a fruitful field for original models.

In very large works, where goods have to undergo treatment in several departments situated in different parts of the premises, mechanical trucks of various kinds are used for transporting them from place to place. In some works these trucks are driven by electric motors, supplied with current from accumulators carried on the trucks themselves. Other trucks, such as the well-known Lister Auto-Truck are driven by small petrol engines. Illustrations and details of the various types of Lister Trucks, which will provide a basis on which models can be based, appeared in the *"M.M."* for March 1930.

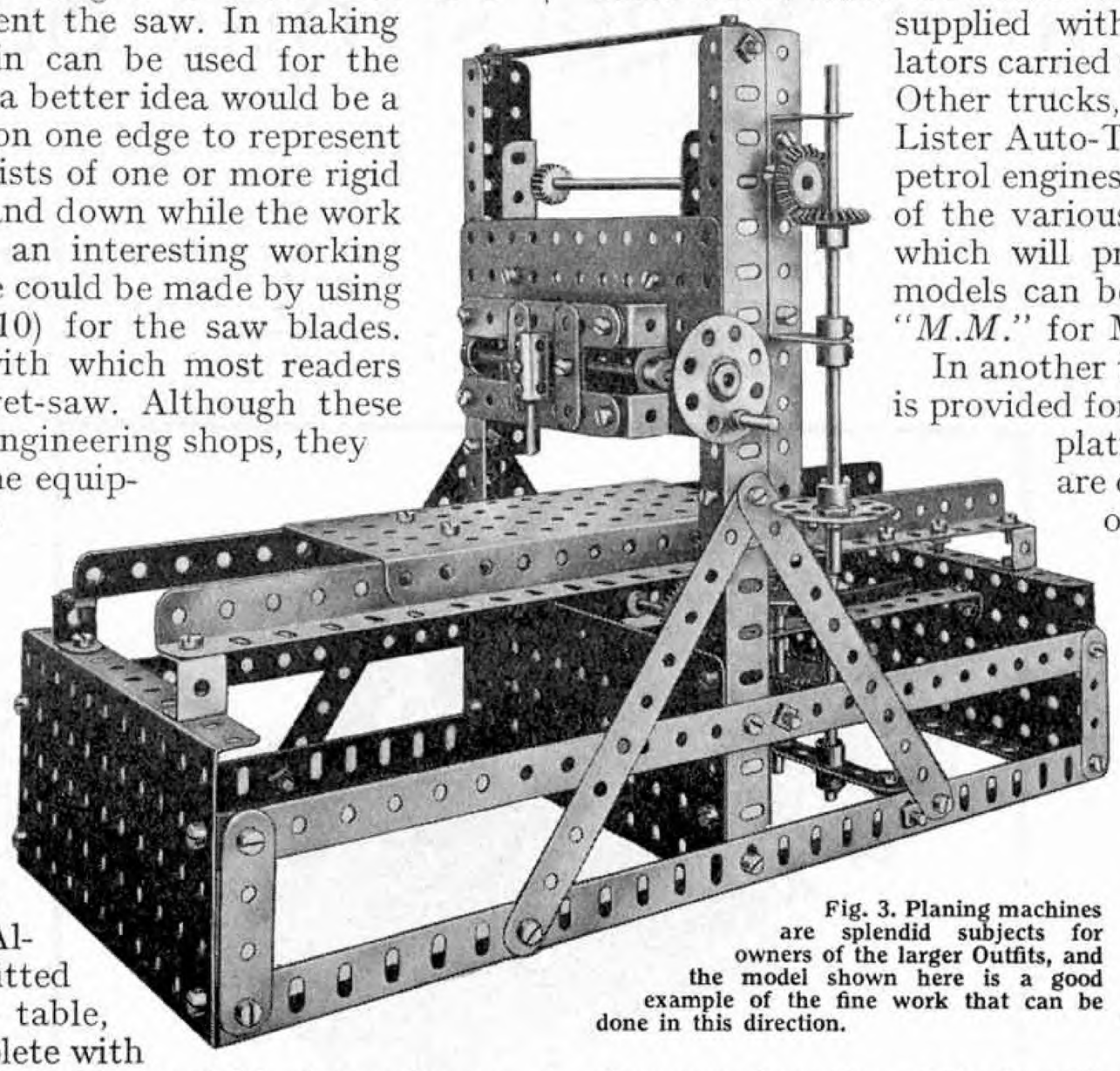


Fig. 3. Planing machines are splendid subjects for owners of the larger Outfits, and the model shown here is a good example of the fine work that can be done in this direction.

In another type of truck, mechanism is provided for raising and lowering the platform on which the goods are carried. In using this type of truck, the materials are stocked on a wooden tray that is raised from the ground by skids or runners to a height sufficient to permit the truck to be run underneath it. Both the tray and the load are then lifted from the ground simply by moving the truck handle up and down. A truck of this kind is the well-known "Collis" truck, in which the upward and downward motion of the handle operates a small hydraulic ram, the plunger of which is connected to link gear that actuates the raising and lowering of the platform. The Collis truck was fully described and illustrated in the *"M.M."* for February 1931, and several splendid Meccano models built by *"M.M."* readers were illustrated in the October 1931 issue.

Boys who possess a sufficient quantity of parts can obtain a great deal of fun by constructing a miniature complete engineering works including a number of small models, such as a lathe, a drill, a press and a milling machine. Models of this kind have often been constructed, but the subject never loses its interest, as changes in the equipment provide so much scope for ingenuity.

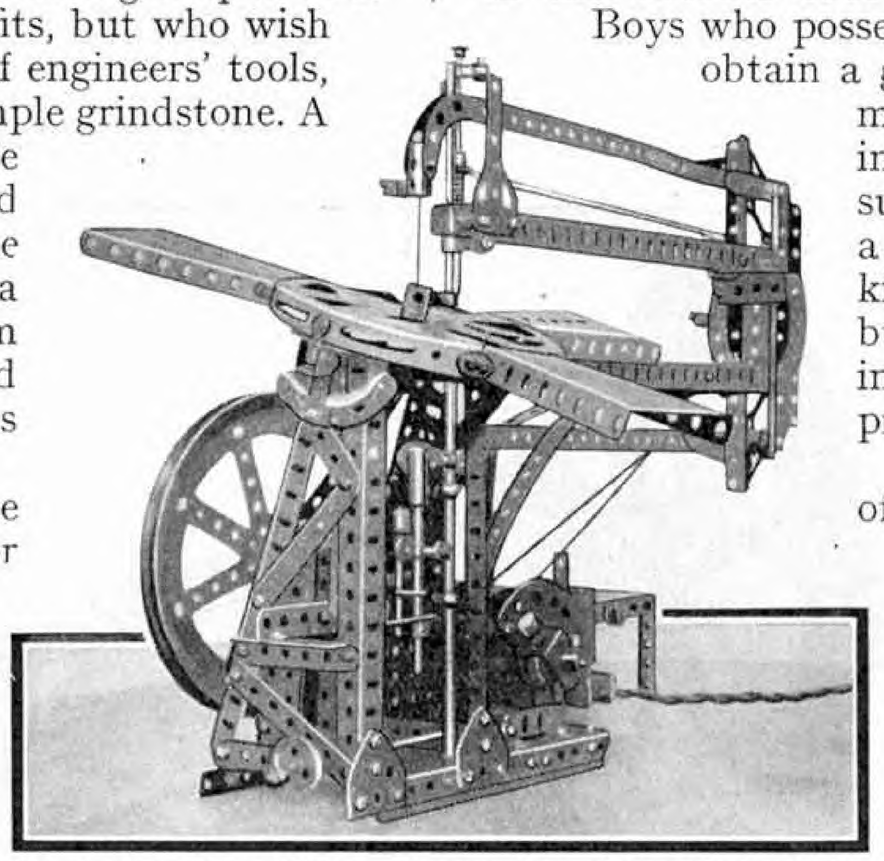


Fig. 4. This model fretwork machine was constructed by D. R. Heeramaneck, Bombay, and is capable of cutting wood up to 3/16 in. in thickness.

The miniature machines in a model of this kind could be driven from overhead shafting in accordance with actual workshop practice. Another good idea is to construct the frame of a factory and fill in the walls with thin white paper. Small models should then be placed inside the workshop and connected up to overhead driving shafts. A strong light should be placed at the rear of the model so that the shadows of the machines can be seen on the paper walls of the workshop. When the models are made to work, and especially if they are attended by Meccanitian workmen, the result is remarkably realistic.

The models need be built in outline only, and it is not necessary for them to be complete in every detail. When arranging the machines they should be placed as near to the front wall of the workshop as possible, so that the shadows are sharp.

Meccano Suggestions Section

By "Spanner"

(388) Automatic Reversing for E6 Electric Motor

(E. Pringle, Edinburgh)

Fig. 388 shows a novel type of automatic reversing movement that can be fitted to the reversing lever of an E6 Electric Motor. Pringle used the mechanism in a demonstration model of a transporter bridge, which he required to operate without attention for long periods. The mechanism will be found useful also in many instances where a model is required to perform a definite sequence of operations, and has the advantage that the period between each reversal of the mechanism can be adjusted as desired.

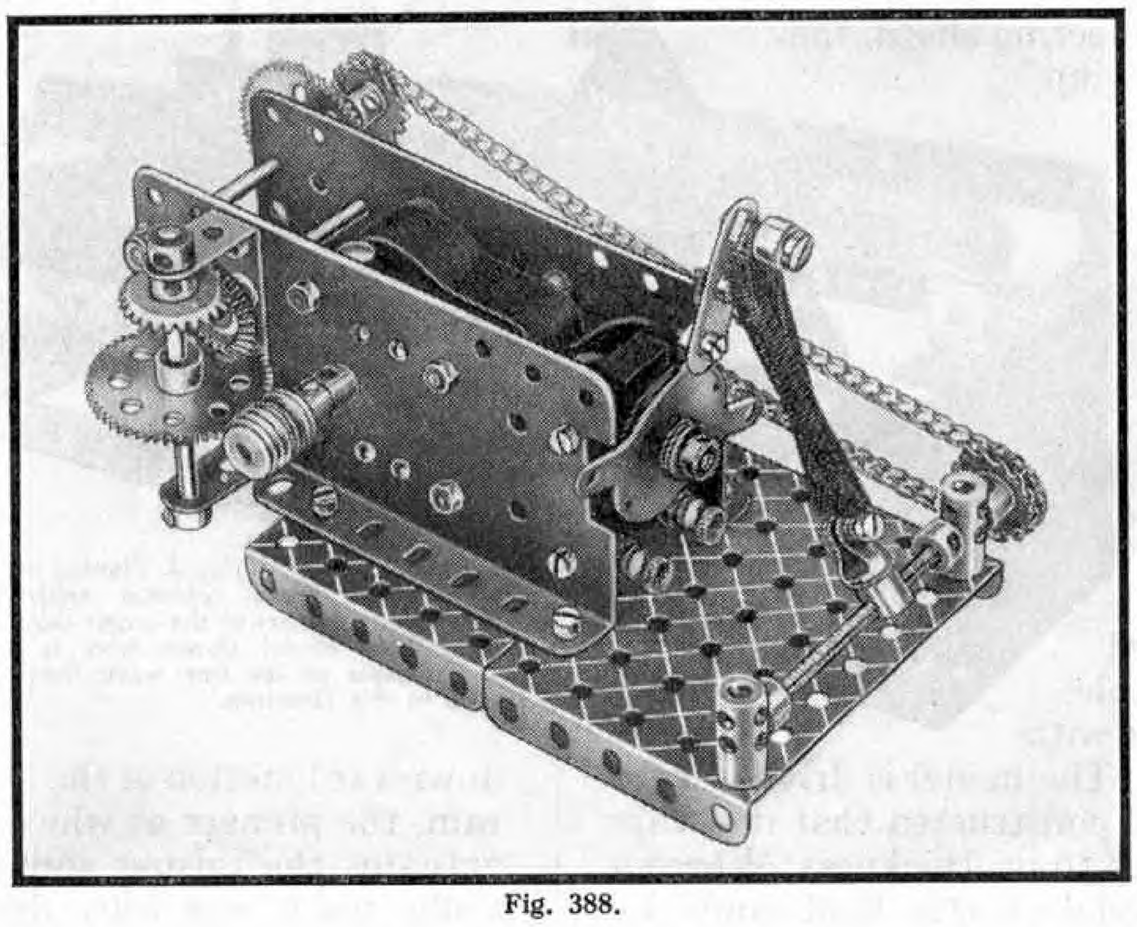


Fig. 388.

The Motor is suitably mounted on a base-plate and a Worm on the armature shaft meshes with a 57-teeth Gear fixed on a 3″ Rod journalled in a 2½″×1″ Double Angle Strip. A ⅞″ Bevel Gear on the 3″ Rod meshes with a similar Gear on a horizontal 2½″ Rod, which carries also a ½″ Pinion. The ½″ Pinion meshes with a 57-teeth Gear on a 3″ Rod, which carries also a ¾″ Sprocket Wheel that is connected by Chain to a ¾″ Sprocket Wheel fastened on a 3½″ Screwed Rod. Bearings for the Screwed Rod are provided by two Threaded Couplings fixed to the base-plate, and an End Bearing on it is connected by Springs to a Pivot Bolt lock-nutted to a 1½″ Strip that is bolted to the reversing lever of the Motor. The drive to the model can be taken from any of the intermediate shafts journalled in the Motor side-plates.

When the Motor is set in operation the End Bearing traverses the Screwed Rod and extends the Springs. As the End Bearing nears the end of its travel the pull of the Springs overcomes the friction of the reverse lever and it snaps over, the Motor being immediately reversed. The End Bearing then travels to the opposite end of the Screwed Rod.

For efficient operation all the rotating shafts and screw mechanism should be well lubricated.

(389) A Meccano Humming Top

(A. Peters, Bristol)

A. Peters, Bristol, has made a good "humming top" from a few parts left over after completing a model. He fastened a Flywheel (Part No. 132) near the pointed end of a Drift (Part No. 1083). He then dismantled an old mouth organ and extracted four of the reeds. These were partly enclosed in metal sleeves, which were then clipped around the rim of the Flywheel, on which they were fixed at equal intervals.

A 12½″ Strip fitted with a Double Bent Strip at one end holds the top upright. The top is spun by the usual method, the string being wound around the upper end of the Drift.

With this arrangement of the reeds, the top can be spun only in one direction. A better effect can be obtained by fitting a second set of reeds with their free ends pointing in the opposite direction. The top can then be spun in either direction at will.

(390) Independent Front Wheel Suspension

(P. Johnson, Leicester)

Good spring suspension in a large model motor chassis usually is necessary in order to obtain smooth reaction to uneven surfaces, and to absorb any shocks to which the model may be subjected. A simple type of suspension that can be fitted to almost any type of chassis is shown in Fig. 390.

The front tie-bar of the chassis is formed by a U-section girder, and it can be attached to the side members of the chassis in which it is to be incorporated by a 1″ Corner Bracket. The 4½″ Screwed Rod 1 passing through the centre transverse bore of a Coupling 3 is also screwed into the tapped hole of a Collar. A 1″ Rod 2 is then passed through the Collar, and through holes in two 1″ Corner Brackets bolted to the U-section girder. Coupling 3 has a 1″ Rod carrying a Compression Spring locked in its longitudinal bore, and the Rod is journalled in the end hole of the girder.

Two 2½″ Strips 4 are lock-nutted to a Double Bracket bolted to the U-section girder, and serve to support the steering mechanism. At their outer ends the Strips are lock-nutted to a Double Bracket and two 1½″ Strips, one at each side of the Double Bracket. A second Double Bracket is bolted below the first, and bolts that carry two washers on their shanks for spacing purposes pass through the Double Brackets, and are screwed into the end transverse tapped bores of a Coupling 5. This Coupling forms the pivot for the front wheel.

The end of Screwed Rod 1 is gripped in a Collar, from which the grub screws have been removed and replaced by 7/32″ bolts. The bolts pass through the end holes of the 1½″ Strips. The road wheel, a 3″ Pulley, is carried on a ½″ Bolt that is screwed into a Collar. This Collar is held on a 1″ Screwed Rod that carries two washers above, and nine Washers below the Collar.

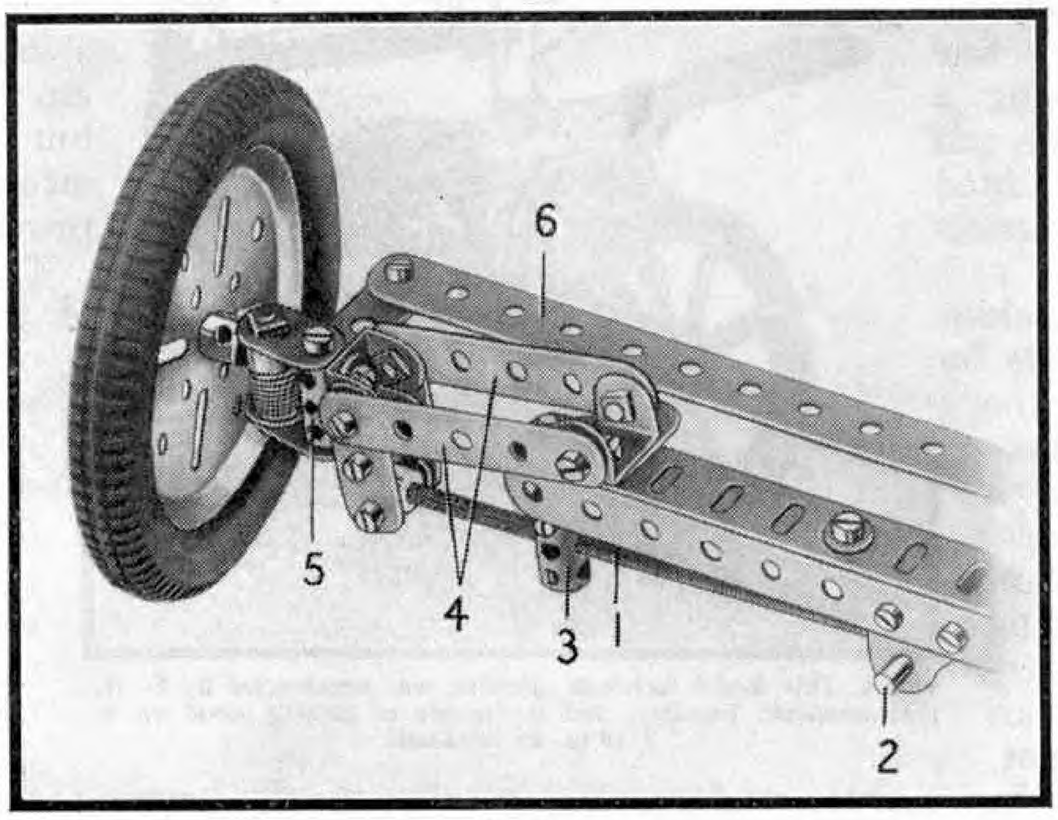


Fig. 390.

A Flat Bracket is slipped on the upper end of the Screwed Rod and a 1″ Corner Bracket, and a 2″ Strip on the lower end, all being held in place by nuts. Bolts are passed through the unoccupied holes of the Corner Bracket and Flat Bracket into the longitudinal bore of Coupling 5, and are held in place by its grub screws. The tie rod 6 is lock-nutted to the end of the 2″ Strip. When the lorry travels over an uneven surface, or when a heavy load is imposed on the chassis, the Compression Spring absorbs the shock.

The suspension may be fitted to the rear wheels of a model, in which case the road wheel axle should be journalled direct in Coupling 5. The rear wheel should be free on the axle and a 57-teeth Gear should be bolted to it. This Gear can be driven by a ½″ Pinion fastened on the end of a Flexible Coupling Unit journalled in the boss of a Crank. The other end of the Coupling Unit can then be coupled up to the drive from the differential. Alternatively, Universal Couplings could be used, but these are not so compact.

(391) An Electric Motor built from Meccano Parts

(S. Pander, Kendal)

A novel type of electric motor submitted by S. Pander, Kendal, is shown in Fig. 391. The motor is very compact and the simplicity of its construction is an outstanding feature. It is not very powerful, but it provides an excellent example of the interesting use that can be made of Elektron parts in conjunction with Meccano parts.

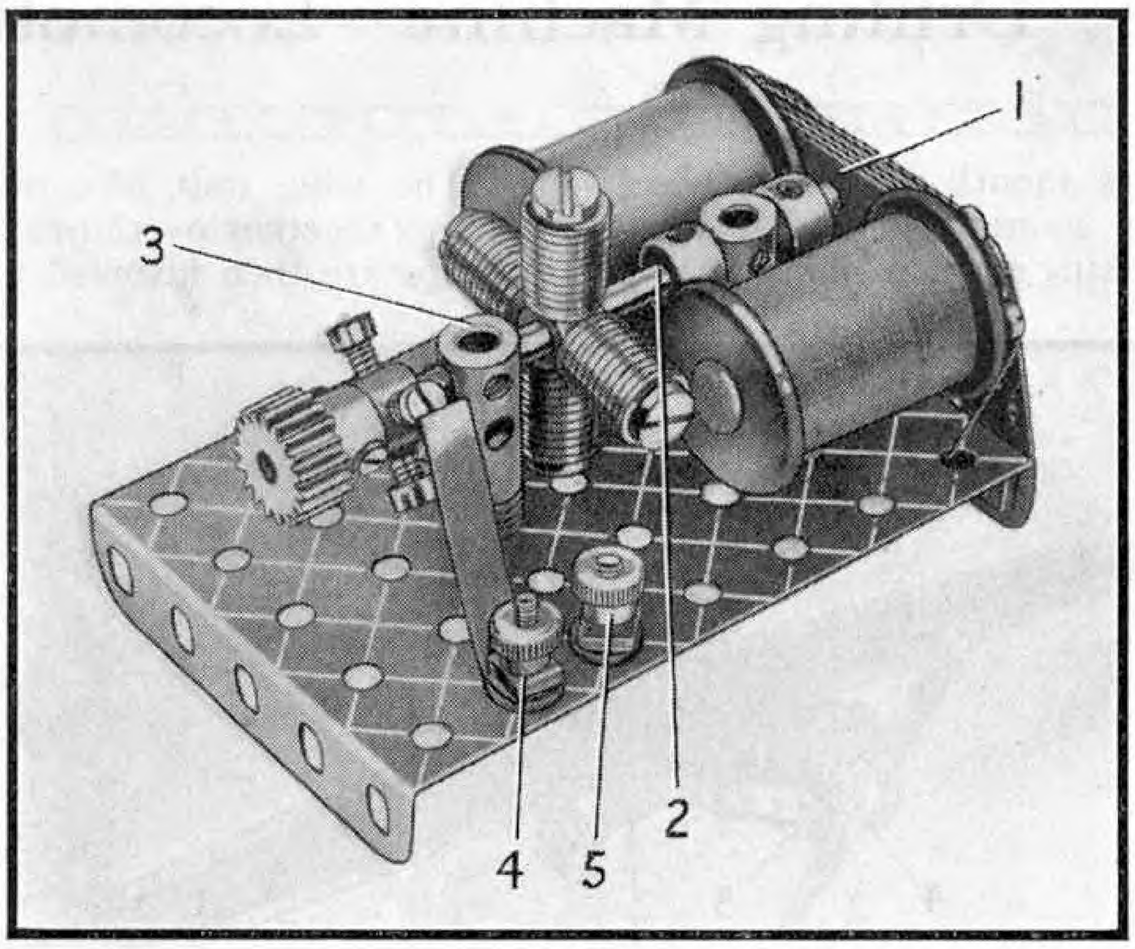


Fig. 391.

The complete motor is carried on a base-plate formed by a $3\frac{1}{2}'' \times 2\frac{1}{2}''$ Flanged Plate. Two Elektron Magnet Coils are fitted with Cores, and mounted on a yoke consisting of five $2\frac{1}{2}''$ Strips. The $2\frac{1}{2}''$ Strips are in turn supported from the base by $1\frac{1}{2}''$ Strips. The armature shaft is a 3″ Rod 2 that carries the armature and commutator. The armature is built up on a "spider" taken from a Universal Coupling. Four Pivot Bolts, each carrying 11 washers on its shank, are screwed into the tapped holes of the "spider." The commutator also is a "spider" but it carries four bolts in its tapped holes.

The armature shaft is journalled in bearings formed by Threaded Couplings held on the base-plate by $\frac{3}{8}''$ Bolts. Each Bolt carries five washers on its shank in order to raise the armature shaft in line with the Magnet Cores. Before tightening up the Bolts, the upper transverse plain bores of the Threaded Couplings should be carefully aligned. The armature is carried between the Threaded Couplings, lateral movement in the shaft being prevented by two Collars. The position of the armature should be adjusted so that it is as near as possible to the ends of the Magnet Cores. The commutator should be so arranged that the bolts are half-way between the poles of the armature. The brush is a Pendulum Connection mounted on a 6BA Bolt, which is insulated from the base by means of an Insulating Bush and Washer. A second 6BA Bolt similarly insulated is fastened next to the Brush Terminal 4.

The electrical connections are made as follows. The outer terminal of the rear Magnet Coil is earthed to the base-plate by fastening the end of the wire to a nut and bolt. The inner terminal of the same Coil is then connected to the outer terminal of the second Coil, and the remaining terminal is connected to Terminal 5 underneath the base by a short length of wire.

The electric circuit to the Magnet Coils is completed when one of the bolts of the commutator makes contact with the brush. The Cores become magnetised and attract the poles of the armature. Just as the poles are almost opposite the Cores the bolt breaks contact with the brush, and the armature continues to revolve until the next bolt makes contact.

The bearings of the armature shaft should be well lubricated with Meccano oil, and the brush should be adjusted very carefully so that the bolts make and break contact at the right moment. If the brush is not adjusted properly the armature will vibrate, but slight alterations in the position of the brush will eliminate most of this. The addition of a small flywheel, such as a 1″ Gear or a $1\frac{1}{8}''$ Flanged Wheel, also will be found helpful.

The Motor can be operated from a type T6 Transformer, but the control switch of the Transformer should not be moved beyond the fourth stud from the "off" position, otherwise the Magnet Coils will become hot and considerable vibration will be set up.

(392) Reversing Movement for No. 1 Clockwork Motor

(W. Raybold, Walsall)

Model-builders who do not possess a reversing Clockwork Motor will find the simple mechanism submitted by W. Raybold, Walsall, a very useful addition to working models such as cranes, in which a reversal of operations is required. It is illustrated in Fig. 392. The mechanism is carried on a base formed by a $2\frac{1}{2}'' \times 1\frac{1}{2}''$ Flanged Plate. Two Trunnions spaced from the Flanged Plate by washers form bearings for 2″ Rod 1, which carries between the Trunnions a 1″ Pulley and a 57-teeth Gear. Bearings for a second 2″ Rod are provided by two $1'' \times 1''$ Angle Brackets. The rear Bracket carries also a Flat Bracket fitted with two Threaded Pins that act as stops. The 2″ Rod carries a Double Arm Crank 2, fitted with a 1″ Triangular Plate and a $1\frac{1}{2}''$ Strip. A $\frac{3}{4}''$ Bolt 3 is lock-nutted to the Triangular Plate and carries also a $\frac{1}{2}''$ Pinion, which meshes with a second $\frac{1}{2}''$ Pinion locked on another 2″ Rod journalled in the remaining hole in the Triangular Plate. This Rod carries also a 1″ Pulley 4. The Driving Band 5 serves to keep the Pinion in mesh with the 57-teeth Gear when the mechanism is in its normal position, and when it is required to reverse the drive the $1\frac{1}{2}''$ Strip is moved over until the Double Arm Crank comes into contact with one of the Threaded Pins.

The drive from the Clockwork Motor is taken to the 1″ Pulley 4 through a Driving Band, which stretches or contracts when the 1″ Pulley moves to and fro. The drive to the model is taken from the 1″ Pulley on Rod 1.

An alternative method of constructing the reverse gear, if this is to be incorporated in a model crane, is to mount the 57-teeth Gear on the end of the Rod forming the winch barrel. A Strip of convenient length can then be used for the reversing lever, and the Pinions should be mounted as follows. The upper Pinion is carried on a $\frac{3}{4}''$ Bolt lock-nutted to the Strip forming the reversing lever, the lock-nuts holding also a Flat Bracket and a Reversed Angle Bracket at right angles to the Strip. These provide bearings for a $1\frac{1}{2}''$ Rod that carries a second $\frac{1}{2}''$ Pinion and a 1″ Pulley. The reverse lever is pivoted in the fourth hole from the end carrying the Pinions, so that by moving the lever up or down, each of the Pinions in turn can be brought into mesh with the 57-teeth Gear.

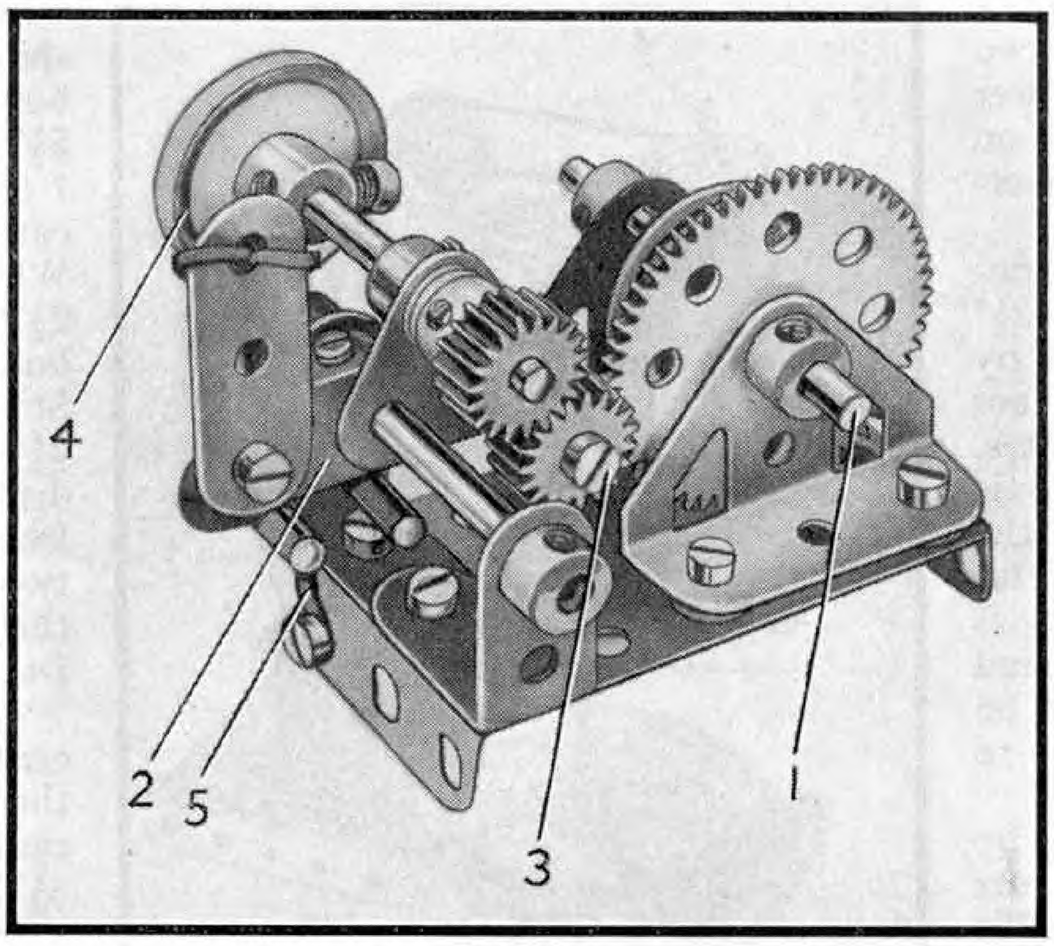


Fig. 392.

(393) Meccano Compasses

(D. Eaton, Coventry)

D. Eaton, Coventry, finding himself short of a pair of compasses, made a pair with the aid of a few Meccano parts. The arms of the compasses are $3\frac{1}{2}''$ Rods, one of which is fitted with a Coupling and the other with a small Fork Piece. A $\frac{3}{8}''$ Bolt passed through the arms of the small Fork Piece, and the end transverse bore of the Coupling provide a pivoted joint. A Coupling, in which a gramophone needle is firmly gripped, is fastened to one $3\frac{1}{2}''$ Rod. A second Coupling fitted with $1\frac{1}{2}''$ Strips is fastened to the other Rod, the ends of the $1\frac{1}{2}''$ Strips being drawn together by a $\frac{3}{8}''$ Bolt and a Threaded Boss. This device is used to grip the pencil.

For more accurate work a screw adjustment can be fitted for opening the arms of the compasses to the correct distance. This can be done with the aid of a Screwed Rod pivoted to one arm and screwed through a Handrail Support fastened to the other arm.

Attractive New Models

Monoplane—Drilling Machine—Locomotive—Scales

THE models described this month are a chemical balance, drilling machine, monoplane and a locomotive. All are interesting working models, and a notable feature of the locomotive is that it is driven by two *Magic* Motors connected to a common driving shaft.

The first of these models to be described is the monoplane shown in Fig. 1. This is based on the Miles "Whitney Straight" monoplane, an outstanding feature of which is a large window at the front of the cabin giving an unbroken view ahead. The construction of the model is commenced by joining two 12½" Angle Girders at one end by a 2½" Strip, and at the other end by a 1½" Strip. A 5½"×2½" Flexible Plate is bolted to each side of the frame so formed, the forward ends of the two Plates being joined by a 3" Strip, bent to shape, and their rear ends connected by a 2½"×1½" Flexible Plate. The rear part of the fuselage is then covered in by a 4½"×2½" Flexible Plate and two 2½"×2½" Flexible Plates. The lower ends of these Plates are braced on each side by two 5½" Strips overlapped three holes.

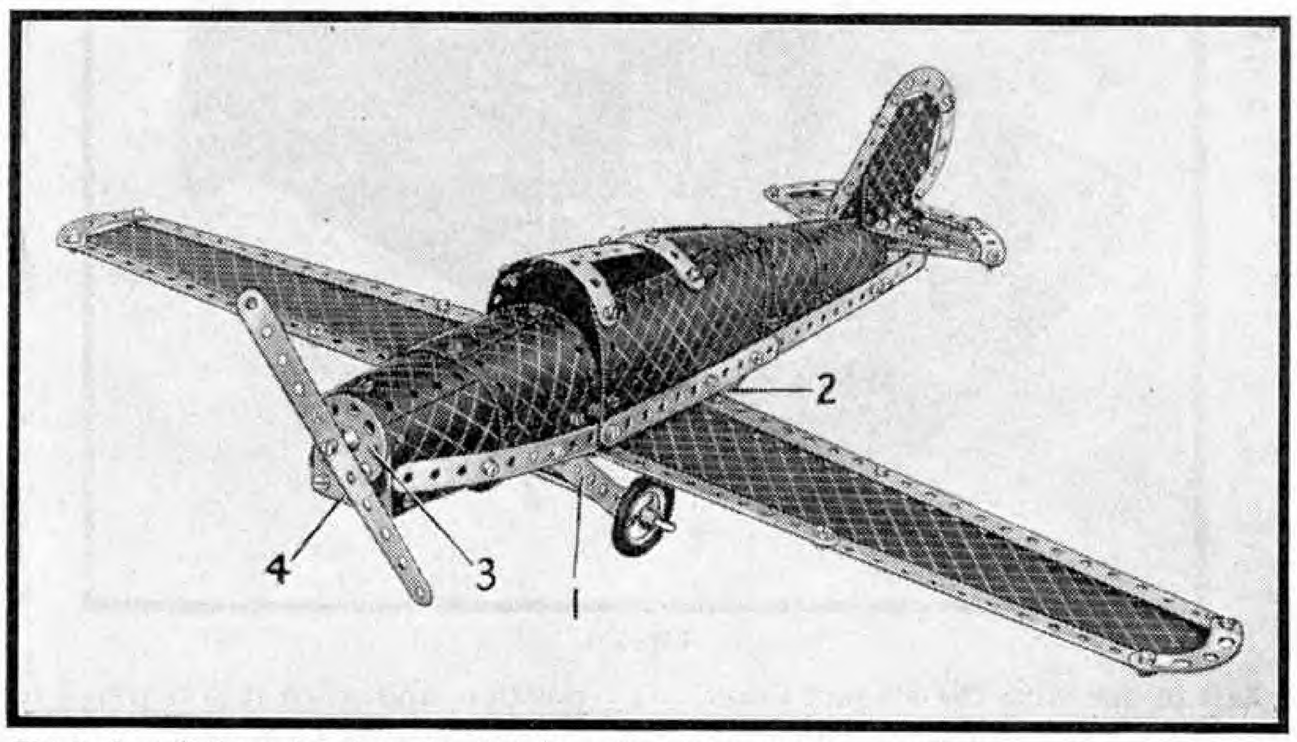


Fig. 1. A realistic model of a Miles "Whitney Straight" monoplane, built from a few simple parts.

The nose of the machine is constructed by extending the 12½" Angle Girders of the fuselage by two 5½" Strips, between which are bolted four 2½"×2½" Flexible Plates. A 1½"×½" Double Angle Strip is bolted between the sides of the nose, and to it is fastened the Flat Trunnion 4. A Bush Wheel 3 is bolted to the Flat Trunnion 4, and in its boss is locked a ⅜" Bolt on which a 5½" Strip is mounted to represent a propeller.

The tailplane is commenced by bolting a 5½" Strip across the rear of the frame of the fuselage. The 5½" Strip is extended rearwards by a 4½" Strip and a 3½" Strip, the correct shape of the tailplane being obtained by bolting around it two 2½" Curved Strips and a 2½" Strip. The rudder consists of 2½"×2½" Flexible Plates, around which are fastened two 2½" small radius Curved Strips and a 3" Strip. The rudder is fastened to the tailplane by an Angle Bracket bolted to the centre of the 5½" Strip.

The wing unit is constructed by bolting two 12½" Strips together overlapping five holes. Two further 12½" Strips are then fastened to the outer ends of this compound strip by 2½" Curved Strips, their inner ends being bolted together overlapping two holes so that they slope slightly backward. The wings are filled in by two 12½"×2½" Strip Plates, and the unit is fastened under the fuselage by means of Angle Brackets.

Each side of the undercarriage is formed by a 3½" Strip 1 and a 4½" Strip 2, which are bolted to the sides of the fuselage. A 4½" Rod, journalled in the end holes of the Strips, carries at each end a 1" loose Pulley that is held in position by two Collars.

Parts required to build the model monoplane: 6 of No. 1; 8 of No. 2; 3 of No. 3; 4 of No. 4; 13 of No. 5; 2 of No. 8; 1 of No. 10; 5 of No. 12; 2 of No. 12c; 1 of No. 15a; 2 of No. 22a; 1 of No. 24; 81 of No. 37; 14 of No. 38; 1 of No. 48; 4 of No. 59; 1 of No. 111; 2 of No. 125; 2 of No. 126a; 2 of No. 142c; 2 of No. 188; 4 of No. 190; 1 of No. 191; 2 of No. 192; 2 of No. 197; 1 of No. 199; 2 of No. 200.

Construction of the small but well-built model drilling machine shown in Fig. 2 is commenced by bolting a 3" Pulley to one end of a 5½"×2½" Flanged Plate. A 3½" Rod 1 fixed in the boss of the 3" Pulley carries at its upper end a Bush Wheel 2, to which are bolted two 2½"×½" Double Angle Strips. The bolts by which the Double Angle Strips are held carry also a 2½"×2½" Flexible Plate that forms the drill table. The upper ends of the Double Angle Strip are joined by two Flat Trunnions, and between their centres is bolted a 1½"×½" Double Angle Strip.

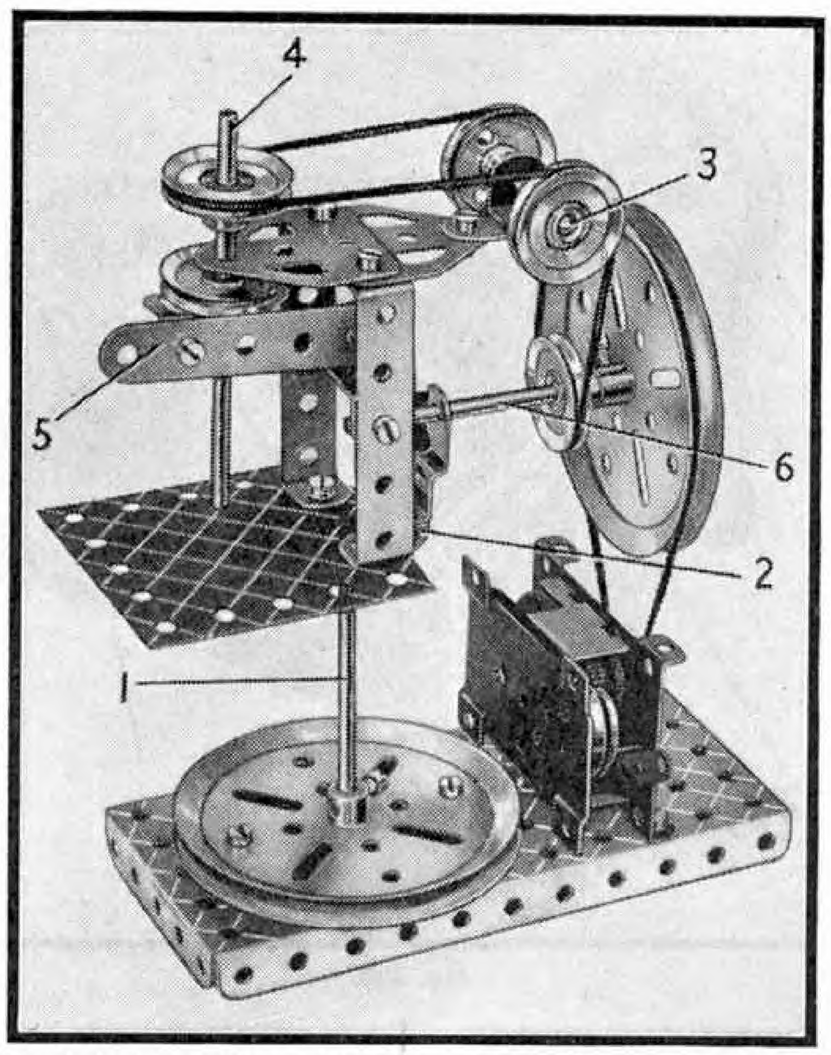


Fig. 2. An interesting model drilling machine that incorporates all the essential details of an actual machine of this kind.

A 1½" Strip is fastened to the centre of the Double Angle Strip, the bolt by which the Strip is fixed carrying also an Angle Bracket. A 3½" Rod 4 forming the drilling shaft is journalled in the end hole of the 1½" Strip, and also in the hole at the narrow end of the Flat Trunnions. The shaft carries two 1" Pulleys, one above the Flat Trunnion and one below it. An Angle Bracket fastened to the lever 5 bears against the lower 1" Pulley, so that the height of the drill can be adjusted by moving the lever up and down. The lever is a 3" Strip lock-nutted at its inner end to the Angle Bracket held by the bolt

that carries the $1\frac{1}{2}$″ Strip supporting Rod 4.

The 2″ Rod 3 is journalled in a Double Bracket secured to the rear Flat Trunnion by a Flat Bracket, and it carries a 1″ fast Pulley and a 1″ loose Pulley. The 1″ loose Pulley is fastened on the Rod by a Spring Clip.

Bearings for the 3″ Rod 6 are provided by a Cranked Bent Strip bolted to Bush Wheel 2, and on it are fixed a 1″ Pulley and a 3″ Pulley. The 1″ Pulley is connected to the upper Pulley on the driving shaft by a Driving Band, which passes also over the two 1″ Pulleys on Rod 3. The 3″ Pulley on Rod 6 is driven by a Driving Band from the small pulley of a *Magic* Motor, which is bolted to the rear of the Flanged Plate that forms the base.

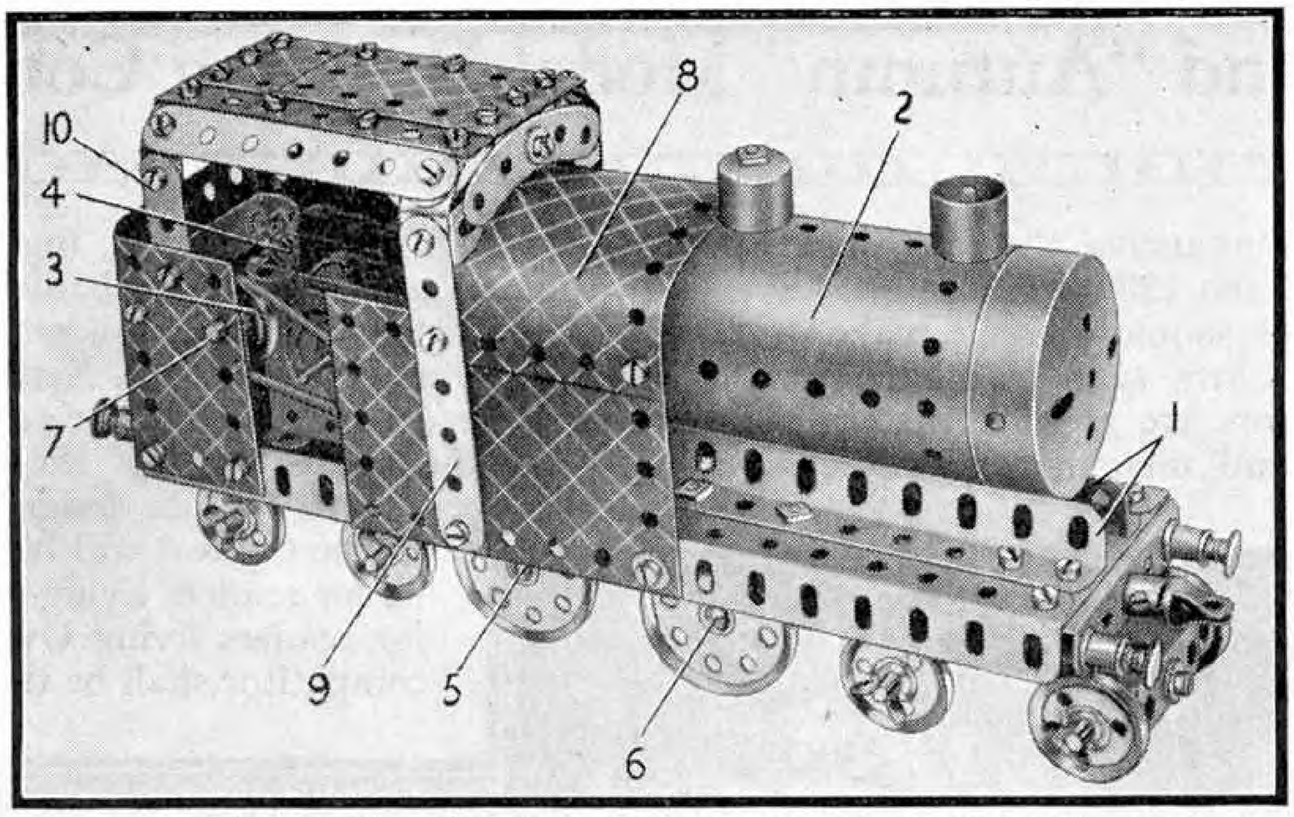


Fig. 3. The driving power for this simple locomotive is provided by two Magic Motors in the cab.

Parts required to build the model drilling machine: 1 of No. 5; 1 of No. 6a; 1 of No. 10; 1 of No. 11; 2 of No. 12; 2 of No. 16; 2 of No. 17; 2 of No. 19b; 2 of No. 22; 1 of No. 22a; 1 of No. 24; 16 of No. 37; 1 of No. 37a; 1 of No. 44; 1 of No. 48; 2 of No. 48a; 1 of No. 52; 2 of No. 126a; 1 of No. 190; 1 *Magic* Motor.

Fig. 3 shows a neat, compact model of a locomotive. The chassis for the locomotive consists of two $9\frac{1}{2}$″ Angle Girders, joined at each end by a $2\frac{1}{2}$″ Angle Girder, and the front part is filled in by a $2\frac{1}{2}$″ × $2\frac{1}{2}$″ Flat Plate. A further two $9\frac{1}{2}$″ Angle Girders 1 are bolted along the centre of the chassis, and on top of them is fastened a Boiler 2. The Boiler is held by a $\frac{3}{4}$″ Bolt that passes through the $2\frac{1}{2}$″ × $2\frac{1}{2}$″ Flat Plate of the chassis. Two Chimney Adaptors are secured to the top of the Boiler to represent the steam dome and chimney, and it is fitted at each end with a Boiler End.

Two pairs of Trunnions are bolted underneath the Angle Girders 1, and in them are journalled the axles 5 and 6, each of which carries two $1\frac{1}{2}$″ Pulleys forming the driving wheels. Each bogie is formed by a $2\frac{1}{2}$″ × $1\frac{1}{2}$″ Flanged Plate, to the flanges of which are bolted two $1\frac{1}{2}$″ × $\frac{1}{2}$″ Double Angle Strips that provide bearings for the axles. A Pivot Bolt is pushed through the centre hole of the Plate and is locknutted through a Double Bent Strip bolted to the Angle Girders 1 supporting the Boiler 2.

The locomotive is driven by two *Magic* Motors, one of which is bolted to each Angle Girder 2. The Pulleys of the Motors are connected by Driving Bands to two 1″ Pulleys 3 on a common axle 7, which is journalled in two $2\frac{1}{2}$″ × $1\frac{1}{2}$″ Flexible Plates bolted to the side of the chassis. The Rod 7 carries also a $\frac{3}{4}$″ Sprocket Wheel 3, which is connected by Sprocket Chain to a 1″ Sprocket on the rear axle 5.

The rear of the Boiler is covered by a $4\frac{1}{2}$″ × $2\frac{1}{2}$″ Flexible Plate 8, which is supported from the chassis by two $2\frac{1}{2}$″ × $2\frac{1}{2}$″ Strip Plates. The roof of the cab consists of four $2\frac{1}{2}$″ × $1\frac{1}{2}$″ Flexible Plates arranged as shown, and along its sides two $3\frac{1}{2}$″ Strips are fastened by Obtuse Angle Brackets. The roof is supported from the chassis by the $3\frac{1}{2}$″ Strips 9, and by the $2\frac{1}{2}$″ Strips 10 from the two $2\frac{1}{2}$″ × $1\frac{1}{2}$″ Flexible Plates bolted to the chassis. The rear of the cab is filled in by a $2\frac{1}{2}$″ × $2\frac{1}{2}$″ Flexible Plate.

The $2\frac{1}{2}$″ Angle Girders at the ends of the chassis are each provided with two Buffers and an End Bearing, the last-mentioned representing the coupling unit.

Parts required to build model locomotive: 4 of No. 3; 3 of No. 5; 1 of No. 6a; 4 of No. 8a; 2 of No. 9d; 1 of No. 11; 1 of No. 12; 8 of No. 12c; 4 of No. 16a; 1 of No. 16b; 2 of No. 17; 4 of No. 21; 2 of No. 22; 8 of No. 22a; 8 of No. 35; 72 of No. 37; 5 of No. 37a; 46 of No. 38; 2 of No. 45; 1 of No. 47; 4 of No. 48; 1 of No. 48a; 2 of No. 51; 4 of No. 59; 2 of No. 69a; 1 of No. 72; 1 of No. 80a; 1 of No. 90; 1 of No. 94; 1 of No. 96; 1 of No. 96a; 1 of No. 111; 2 of No. 111c; 4 of No. 120a; 4 of No. 126; 1 of No. 126a; 2 of No. 147b; 1 of No. 162; 2 of No. 164; 2 of No. 166; 2 of No. 186; 7 of No. 188; 3 of No. 190; 1 of No. 191; 2 *Magic* Motors.

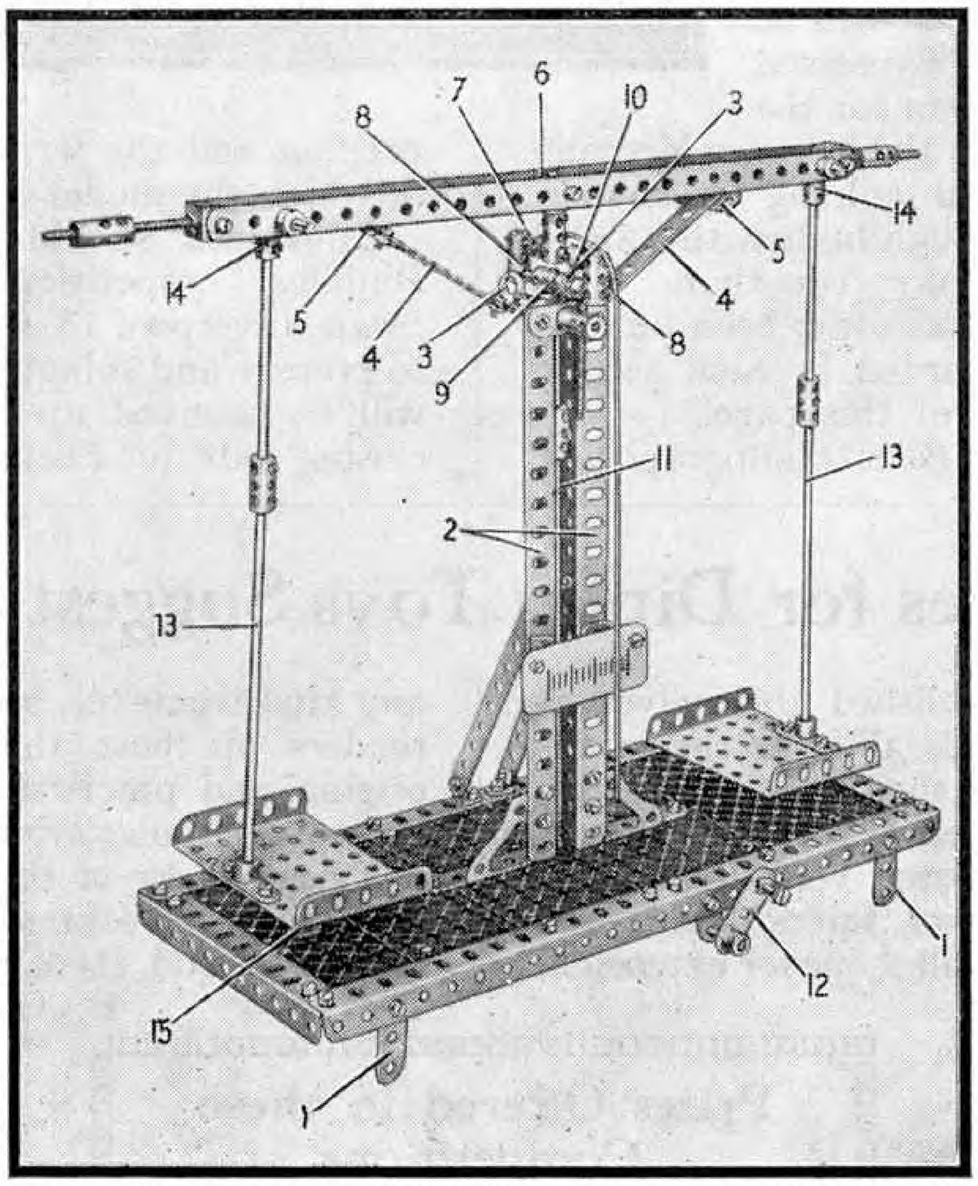


Fig. 4. This balance is simple to build, and if carefully adjusted can be used to weigh light articles of many kinds.

The column for the balance shown in Fig. 4 is formed by two $9\frac{1}{2}$″ Angle Girders 2, fastened to the base by two Flanged Brackets and joined together at their upper ends by a $1\frac{1}{2}$″ Strip. The Bolts fixing the $1\frac{1}{2}$″ Strip also carry two Reversed Angle Brackets 3, to each of which a 3″ Strip 4 is attached by an Obtuse Angle Bracket. Two $1\frac{1}{2}$″ Strips 5 bolted across the upper ends of the Strips 4 form supports on which the beam rests.

The beam is made with two $12\frac{1}{2}$″ Strips joined at their ends by Double Brackets, a Coupling 6 being fastened between the Strips at their centres.

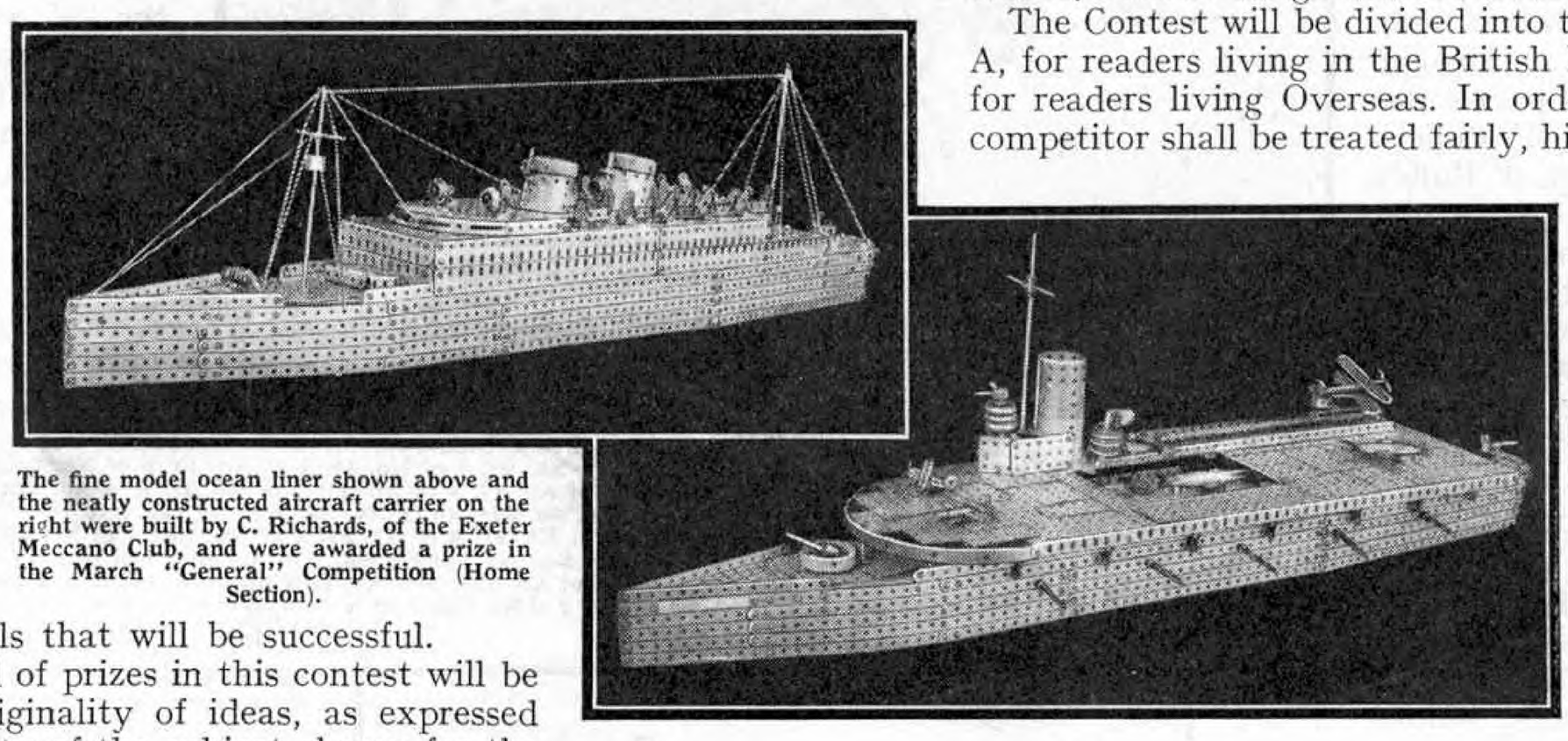
This Coupling is connected by a 1″ Rod to a second Coupling pivoting on Rod 7, supported in two Couplings 8. Two $1\frac{1}{2}$″ Rods are locked in the lower ends of the Couplings, and their inner ends are joined by Coupling 9. The latter is locked on Rod 11, which carries at its lower end a 1″ Pulley. A Flat Bracket, fixed by a Collar to the Rod of Crank 12, bears against the Pulley, so that by depressing the Crank the beam is lifted off its supports.

Parts required to build the chemical balance: 2 of No. 1; 2 of No. 2; 2 of No. 4; 6 of No. 6a; 2 of No. 8; 2 of No. 9; 2 of No. 10; 5 of No. 11; 2 of No. 12; 1 of No. 12a; 2 of No. 12c; 1 of No. 13a; 2 of No. 14; 1 of No. 15; 2 of No. 15b; 2 of No. 16a; 2 of No. 17; 1 of No. 18a; 3 of No. 18b; 1 of No. 22; 7 of No. 37; 6 of No. 37a; 3 of No. 38; 2 of No. 53; 4 of No. 53a; 10 of No. 59; 1 of No. 62; 2 of No. 62b; 9 of No. 63; 4 of No. 63c; 2 of No. 70; 3 of No. 81; 4 of No. 125; 1 of No. 147b.

Meccano and Dinky Toys Competitions

Grand "Autumn" Model-Building Contest

This month we are announcing the first important model-building contest of the 1937-8 season, and every owner of a Meccano Outfit should at once make up his mind to take part in it. Any type of model may be entered, so that competitors are at liberty to give full rein to their ingenuity and imagination. There is no restriction in regard to the size of Outfit or the number of parts that may be used, but it should be remembered that it is not necessarily the most elaborate and intricate models that will be successful.



The fine model ocean liner shown above and the neatly constructed aircraft carrier on the right were built by C. Richards, of the Exeter Meccano Club, and were awarded a prize in the March "General" Competition (Home Section).

The award of prizes in this contest will be based on originality of ideas, as expressed by the novelty of the subject chosen for the model or in the manner in which the various Meccano parts are used, as well as on skill in building the models. An entry of a novel type, even though built with a small Outfit, will have a greater chance of success than a large and elaborate one of a type that has often been built.

A list of the prizes to be awarded in each section appears in the panel at the foot of this page.

Competitors should send only clear photographs or drawings of their models, together with a brief explanation of any special mechanism or interesting detail of construction not clearly shown in the illustrations. Actual models must not be sent. Neither photographs nor drawings need be the competitor's own work, but it is essential that the model itself is the result of his own unaided efforts, both in design and construction.

The Contest will be divided into two Sections, A, for readers living in the British Isles, and B, for readers living Overseas. In order that each competitor shall be treated fairly, his age will be taken into consideration when his model is judged.

Each entry must bear the competitor's name, address and age on the back, and also the title of the competition and the letter indicating the Section, A or B, in which the model is submitted.

Envelopes should be addressed "Autumn Model-Building Competition," Meccano Ltd., Binns Road, Old Swan, Liverpool 13. Competitors are allowed ample time to prepare and submit their entries. Entries for Section A will be received up to 30th November, 1937, and the closing date for Section B is 31st January, 1938.

Prizes for Dinky Toys Suggestions

Dinky Toys have rapidly established themselves as firm favourites with boys and girls all over the world. One of the outstanding reasons for their great popularity is the wide range of subjects covered. Already one can obtain models of all types of motor vehicles, and of famous aeroplanes and flying boats, liners, trains and dozens of other subjects. There is still scope for extension, however. Most readers of the "*M.M.*" no doubt have good ideas for new models that would be popular if included in the Series, and we are organising this special competition in order to give them an opportunity of putting these ideas forward.

All that competitors have to do is to write on postcards suggestions for 10 new items not already contained in the Dinky Toys Series. Suggestions may cover subjects of any kind whatever, but the prizes will be awarded to the senders of those that the judges consider the most original and practical, and which would be most likely to prove popular with Dinky Toys collectors generally.

Every reader of the "*M.M.*" is eligible to send in an entry in this contest, irrespective of age or place of residence, and there will be one section only.

Entries should be addressed "Dinky Toys Suggestions Competition," Meccano Ltd., Binns Road, Liverpool 13, and must be posted in time to reach Liverpool before 31st December, 1937. Details of the prizes to be awarded are given in the accompanying panel.

The judges' decision as to the 10 best suggestions must be accepted as final. Prize-winners will be notified by letter as soon as possible after the closing date of the Contest.

Prizes Offered in these Competitions

"Autumn" Model-Building Contest

1st Prize, Meccano or Hornby Products value £3/3/–.
2nd Prize, Meccano or Hornby Products value £2/2/–.
3rd Prize, Meccano or Hornby Products value £1/1/–.
Five Prizes of Products value 10/6.
Ten Prizes of Products value 5/–.
Certificates of Merit also will be awarded.

"Dinky Toys Suggestions" Competition

1st Prize, Meccano or Hornby Products value £2/2/–.
2nd Prize, Meccano or Hornby Products value £1/1/–.
3rd Prize, Meccano or Hornby Products value 10/6.

Model-Building Competition Results

By "Spanner"

March "General" and April "Bridge" Contests

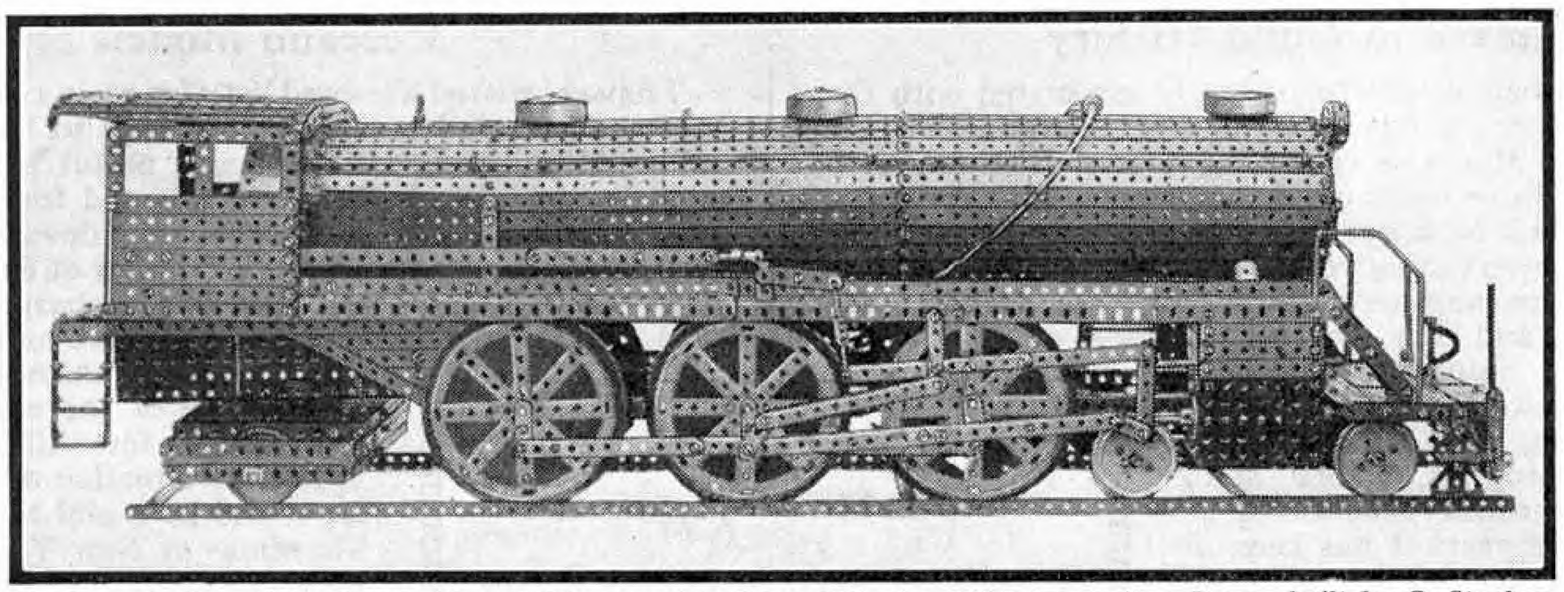
March "General" Contest (Overseas Section)

The awards in the March "General" Contest (Overseas Section) are as follows:

1ST, Meccano or Hornby products value £3/3/–: C. Beese, Hamilton, Ontario. 2ND, products value £2/2/–: G. Stanley, Johannesburg. 3RD, products value £1/1/–: J. Ancall, Addington, Christchurch, New Zealand.

Products value 10/6: H. Young, Sussex, New Brunswick; S. Bossi, Torino, Italy; R. Myburgh, Claremont, Cape Province; E. Rose, P.O. Pinetown, Natal; J. Giese, Buenos Aires.

Products value 5/–: J. Rowston, Orange, Australia; Gino Cali Corleo, St. Julians, Malta; H. Dressler, Breslau, Germany; R. Stuart, Ohakune, New Zealand; D. Mullick, Calcutta.



Neatness is the outstanding feature of this prize-winning model of a 4-6-2 locomotive. It was built by G. Stanley, Johannesburg, and represents an engine in use on the South African Railways.

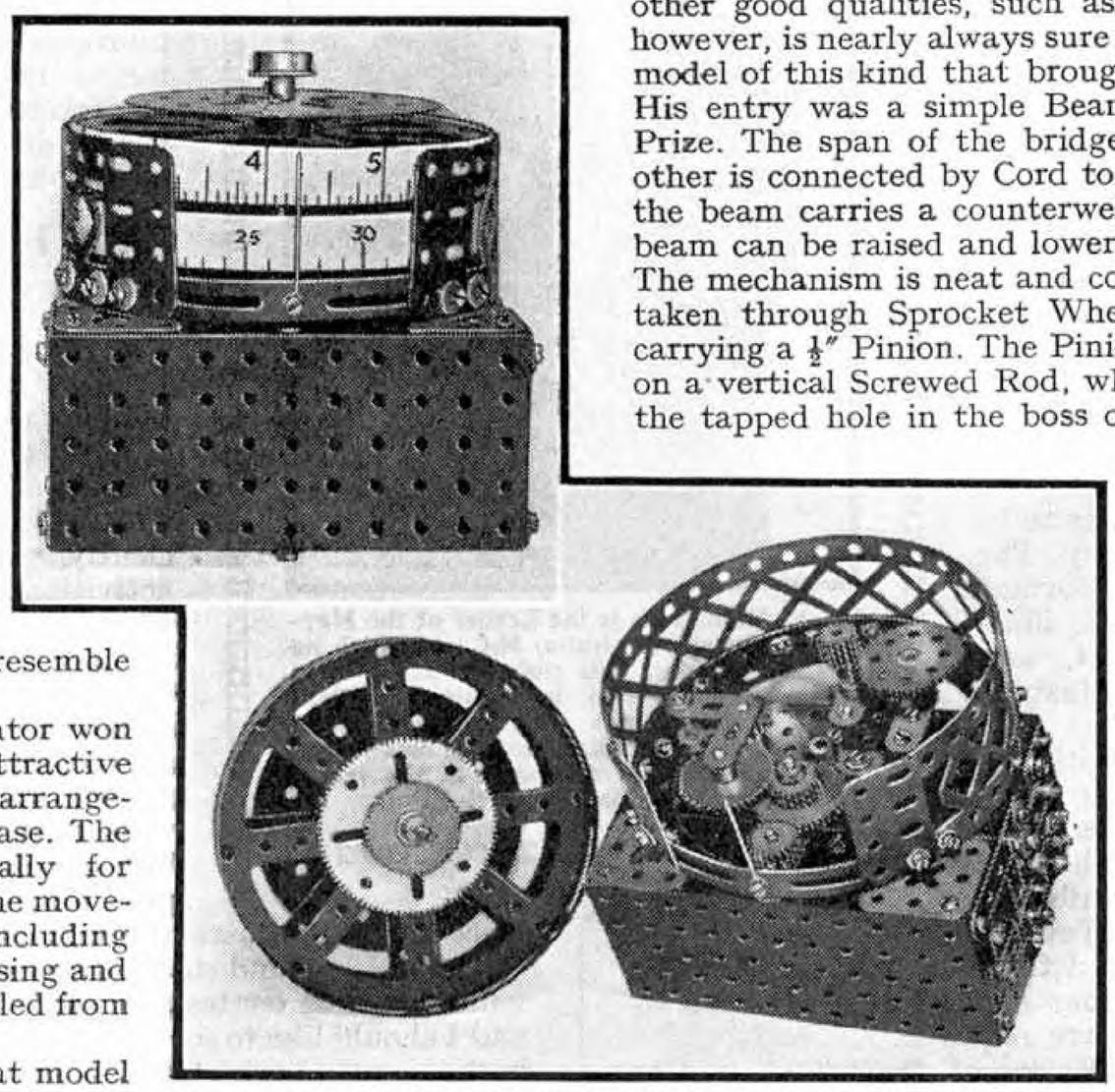
The model that won First Prize for Carl W. Beese is one of the most ingenious and interesting that I have seen for some time. It is the electric clock shown in the lower illustration on this page. This is of an unusual type, the hours, minutes and seconds being shown on two rings that rotate horizontally, one above the other. The clock is driven by a simple synchronous motor built up entirely of Meccano parts. The upper dial turns through one revolution every 12 hours and shows the hours and minutes, and the lower ring rotates once a minute and indicates seconds. Only part of each dial is visible, and a vertical pointer or finger set at the front of the clock marks the exact time. The time shown on the clock when the photograph was taken was 4 hrs. 15 min. 27 sec.

G. Stanley, Johannesburg, won Second Prize with the fine model locomotive illustrated on this page. It represents a type of "Pacific" engine used on the South African Railways, and is complete with Walschaerts valve gear and a driving cab fitted out as closely as possible to resemble that of its prototype.

A model of a mechanical excavator won Third Prize for J. Ancall. An attractive feature of this entry is the neat arrangement of the mechanism in the base. The excavator was intended originally for demonstration purposes, and all the movements of which it is capable, including travelling, slewing, luffing and raising and lowering of the bucket, are controlled from an automatic gear-box.

E. Rose of Natal, entered a neat model of a motor lorry driven by an Electric Motor situated under the bonnet. This model includes plenty of detail of the usual kind, and has a novel feature in a throttle-regulated resistance controller, by means of which the speed of the Motor can be varied. A rear light and headlamps are supplied with current by a small dry battery mounted under the platform of the lorry, and are controlled by means of a switch on the instrument board.

A fine model electric train of the overhead pantograph type won a prize for Julio Giese, Buenos Aires.



The novel electric synchronous clock that won First Prize in the Overseas Section of the March "General" Contest for Carl W. Beese, Hamilton, Ontario. The lower illustration shows the clock partly dismantled.

April "Bridge" Contest (Home Section)

1ST PRIZE, Meccano or Hornby products value £3/3/–: R. Drake, Dorchester. 2ND, products value £2/2/–: H. Thomas, Edgware. 3RD, products value £1/1/–: S. Moore, London, N.11.

Products value 5/–: P. Frost, Nottingham; S. Bayley, Grays; D. Holden, Cowley, nr. Uxbridge; D. Leadbeater, Manchester 21; L. Hatherell, Bristol; F. Nunn, Colchester; W. Goodmann, Allestree, Nr. Derby; M. Tabard, Wembley; R. Clark, Nottingham; S. Hill, Berkhamstead.

The most notable entry in this Contest was a splendid reproduction of the famous Rialto Bridge at Venice, which was sent by R. Drake, Dorchester. This is not a large model. Drake has used only a few parts in its construction, but he has assembled these so skilfully that he has succeeded in obtaining a remarkably realistic effect. It was this feature of the model that attracted the attention of the judges and influenced their decision to award it First Prize.

Models that "work" are more attractive than models that cannot be set in motion, but movement alone will not ensure success in competitions. A model in which good movement is combined with other good qualities, such as sturdy construction and neatness, however, is nearly always sure of a place in the prize list, and it is a model of this kind that brought success to H. Thomas, Edgware. His entry was a simple Beam Bridge and was awarded Second Prize. The span of the bridge is pivoted at one end, and at the other is connected by Cord to an overhead beam. The rear end of the beam carries a counterweight, consisting of a Boiler, and the beam can be raised and lowered by means of a Clockwork Motor. The mechanism is neat and compact. The drive from the Motor is taken through Sprocket Wheels and Chain to a horizontal rod carrying a ½" Pinion. The Pinion is in mesh with a Contrate Wheel on a vertical Screwed Rod, which passes at its upper end through the tapped hole in the boss of a Rod Socket fixed to the end of the beam.

S. Moore gained Third Prize with a model of a cantilever bridge. This is strongly built and has a neat and pleasing appearance, and it is evident that a great amount of care was taken in its construction.

One of the smaller prizes was awarded to D. Leadbeater, Manchester, for a model of a swinging bridge. The roadway of the bridge is made in two parts, which can be made to swing, simultaneously or independently, by turning a handle that connects with a small gear-box. At the end of each approach are two lamps, one red and one green, and these can be illuminated to indicate whether the roadway is open or closed.

L. Hatherell, Bristol, sent a model transporter bridge. It does not possess any particularly outstanding features, but is well built throughout. This competitor is only 11½ years of age, but his work shows great promise and I hope to see other models from him in future contests.

A particularly neat model of a beam bridge, which has been very carefully constructed, was sent by F. Nunn, Colchester.



A Landmark in Guild History

The Meccano Guild has always been closely associated with the *"Meccano Magazine,"* which has been its official organ since its formation in 1919. The Magazine celebrates its 21st Birthday with this issue, and is thus three years older than the Guild.

It is interesting to look back upon the early days and to see how each has grown in the intervening years. What has happened to the Magazine is described on another page in this issue. It has made magnificent progress and has thoroughly established itself as a unique magazine of interest to all boys and of special value to Guild and club members. The Guild has made equally wonderful progress. More than 100,000 boys have enrolled themselves as members during the 18 years it has been in existence, and its influence has spread to all parts of the world. The Guild pages of the Magazine give some indication of its importance to-day, the club reports especially showing both the range of the clubs and the wide interests of members. The crowded character of this section is indeed in striking contrast to the brief notes and reports that were sufficient when the movement began.

The Guild itself will come of age in 1940, and every member will join with me in congratulations to its official organ on having already reached that dignity.

New Lantern Lectures

I have received from the British Railways Press Office details of two new lantern lectures that are available on loan. These lectures are supplementary to the three mentioned on this page in the October 1936 *"M.M.,"* and are entitled *"Trains, Tracks and Travel"* and *"Railway Docks"* respectively. The first set of slides shows modern booking offices, interiors of railway steamships and similar scenes, and includes coloured illustrations of scenes to be found at the end of a railway journey. The second set deals with the more important railway-owned docks in Great Britain, illustrating their layout and equipment, and their position in relation to inland industrial centres.

A descriptive booklet is supplied with the slides to enable an interesting running commentary upon them to be given. Leaders who wish to obtain the loan of any of the five lectures should apply to the British Railways Press Office, 35, Parliament Street, Westminster, London, S.W.1. There is certain to be a great demand for them, particularly for the two new lectures, and applications should be made well in advance of the date for which they are required.

A joint railway film entitled *"Pathways of Perfection"* is also available on loan from the same source. This film shows the four principal main line trains and their journeys from London to their various destinations.

Lantern and film lectures are always a great attraction during the winter session. A list of such lectures that can be obtained from various firms and railway companies is available, and I shall be pleased to send a copy to Leaders and secretaries who do not already possess one. The list indicates the nature of each lecture, and gives full information about how to obtain them.

Meccano Club Leaders

No. 91 Mr. V. Malmgreen



Mr. V. Malmgreen is the Leader of the Maylands (Western Australia) M.C., of which he was the founder. This club was affiliated in February 1936, and is making excellent progress. Very keen interest is taken in Meccano model-building, and the club staged a splendid display of models at the recent West Australian Industries Fair.

Meccano Models on Loan

I have prepared a revised list of models available for loan to clubs, and shall be glad to send copies of it to Leaders or secretaries of affiliated clubs. There are many useful purposes to which these models can be put. They are splendid for Exhibitions and other model displays, and it is worth while devoting special meetings to examination of them as fine examples of design and construction. They are built and despatched free of charge, and the only expense incurred by a club making use of them is the return carriage, the amount of which depends on the size of the model and in no case is more than a few shillings.

The introduction of the new list is timely, for it will be useful to officials planning their Christmas or New Year Exhibitions. It may seem premature to suggest so early in the session that plans of this kind should be made. It is not too soon to begin preparations, however. Members should not be hurried over the models they build for display or entry in competitions, and generally time and effort devoted now to working out details is worth twice as much as that spent in a breathless hurry at the last moment. In particular those who wish to add a model from Headquarters to the attractions of their Exhibitions should let me know their requirements in good time. Our Model-building Department is always busy at this time of the year and at least five weeks' notice is advisable.

Club Entries in "M.M." Model-Building Contests

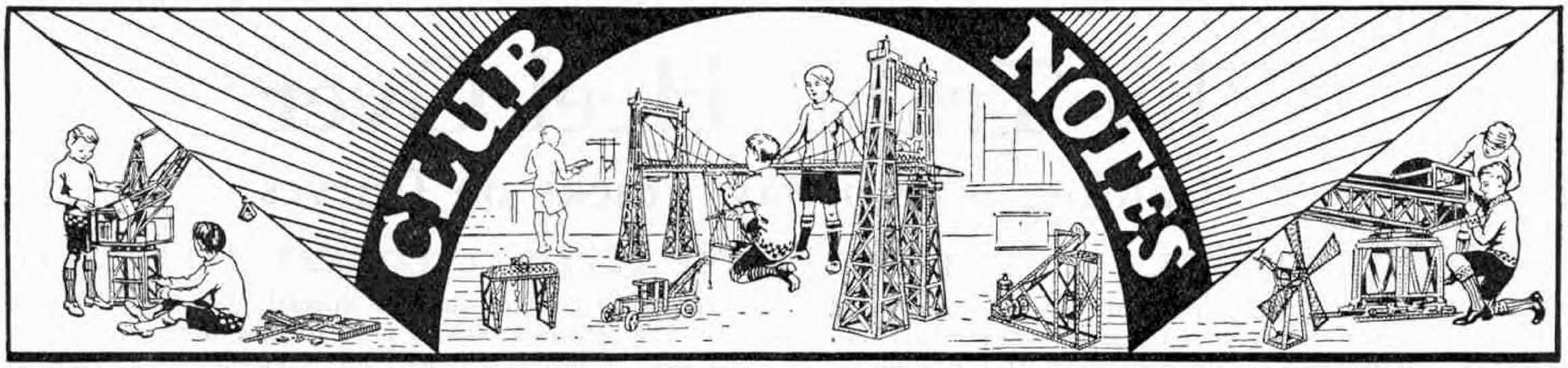
I should like to draw the attention of Leaders to the Grand "Autumn" Model-building Competition announced on page 616 of this issue, and to urge them to persuade their members to take part in this and in other similar contests. The range of these is sufficiently varied to cover the model-building activities of every club, and it does not matter whether the models entered have been built for an Exhibition or constructed in the course of ordinary model-building meetings, so long as the rules of the contests are followed. It is a great encouragement to members when their models not only receive the admiration of visitors to the club-room or the Exhibitions, but also win prizes in the *"M.M."* competitions, and thus are made known to Meccano enthusiasts throughout the world.

The officials and members of one or two clubs have realised the value of these contests in stimulating model-building enthusiasm, and I should like to see many more names of Meccano club members in the monthly prize lists than have appeared in the past.

Proposed Clubs

Attempts are being made to establish Meccano Clubs in the following places, and boys interested should communicate with the promoters whose names and addresses are given below:

BARRY—J. R. Berg, 39, Broad Street, Barry, Glamorganshire.
LONDON, E.3—A. Knight, 14, Lessada Street, Bow, E.3.
NEW ZEALAND—R. Watson, Park Street, Winton, Southland.
SHALDON—B. Williams, 1, Clifford Terrace, Ringmore Rd., Shaldon.



Barking M.C.—Meetings during the past session were very well attended. Model-building Evenings were the most popular, with Hornby Train meetings a good second. An interesting innovation was the working of models by elastic "motors," and by weights and flywheel momentum. Contractor's Nights and meetings devoted to criticisms and suggestions, were also very successful. An interesting Visit has been paid to the docks at Woolwich, where the party were able to see a large boat pass through the locks. Club roll: 8. *Leader:* Mr. G. B. Weightman, 47, Sherwood Gardens, New Barking, Essex.

Old Charlton M.C.—A varied programme has been carried out. A debate on the motion that "*Steam is better than Electricity on the Railways*" ended in favour of steam traction. The sequel was a talk by the Leader on the subject at a later meeting. On a Model-building Evening some excellent models built by members at home were brought in, and a locomotive turntable was built during the evening. One meeting was devoted to conjuring tricks, and a novel variation was provided recently by a "Progressive Games" Evening. The games were arranged along a table so that members could sit in front of them and play for two minutes. Each member then moved one place to his right, leaving the previous game to be continued by his successor. As each game was completed the winner's name was taken down and marks awarded to him. The procedure proved amusing and interesting. Club roll: 22. *Secretary:* W. Bailey, 63, Rectory Grove, Woolwich, London, S.E.18.

Mall School M.C.—A few meetings have been held, and at one of them an interesting Knowledge Test was much enjoyed. At one model-building meeting a cup was presented for the best model completed. Club roll: 25. *Secretary:* A. James, 45, Pope's Grove, Twickenham.

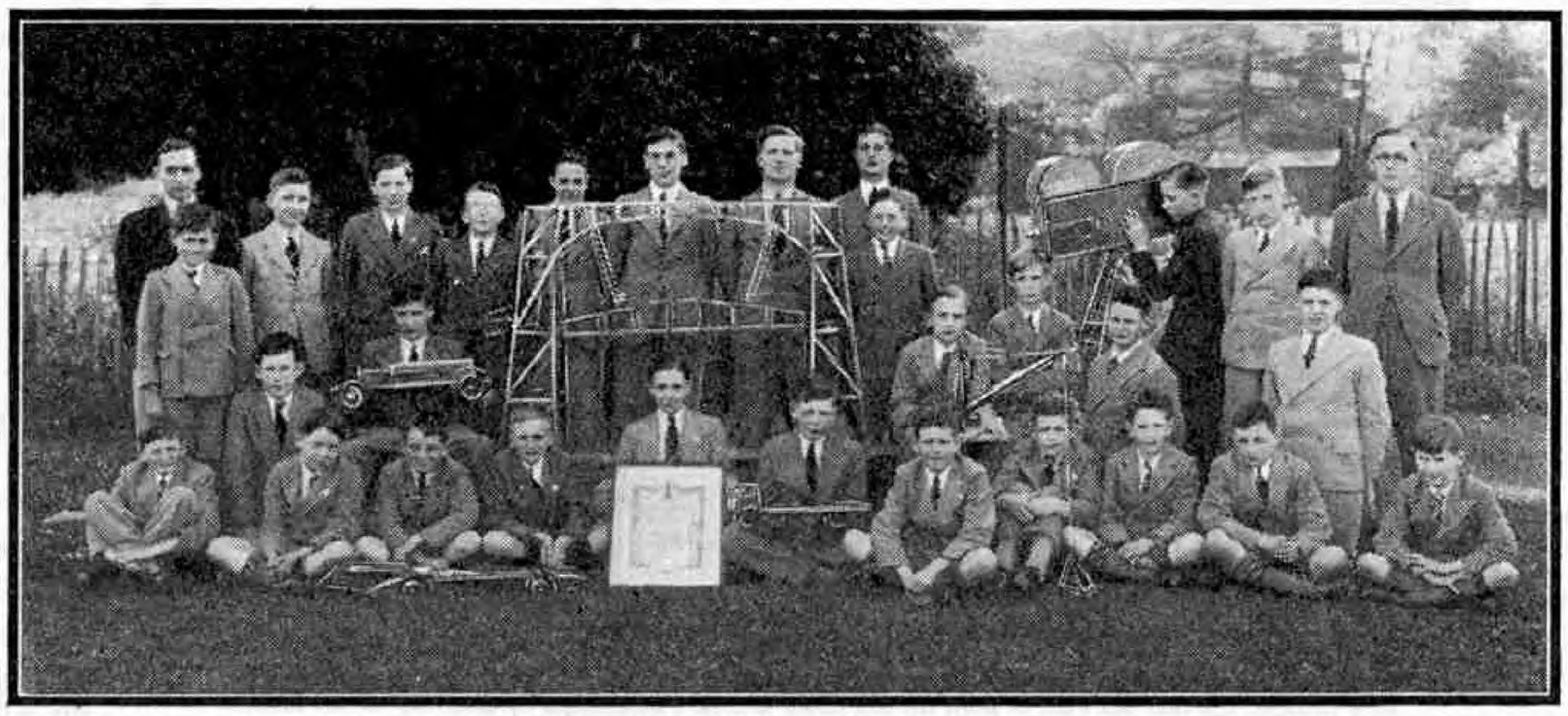
Well Hall and District M.C.—All the members are cyclists, and summer meetings took the form of Cycle Runs to places of interest. Several good Meccano models have been built by individual members, however. Most of the models are large "heavy duty" lorries, and great enjoyment has been obtained by employing them for long-distance transport. An electrically-driven trolley bus proved so successful that a large 12-wheeled lorry and trailer, with an overall length of 4 ft., are being built. The lorry will be driven by an electric motor worked from the mains supply. Club roll: 6. *Secretary:* B. K. Frooms, 82, Greenvale Road, Eltham, London, S.E.9.

Wednesbury M.C.—The track of the Model Railway Section has been relaid, and additional track and rolling stock have been acquired. Excellent model-building has been carried out, outstanding models completed recently being an automatic Bagatelle game and a derrick crane. New tools have been purchased for the Woodwork Section to enable larger work to be attempted. One member is busy constructing a doll's house, and the treasurer has made a handsome stationery rack. A member of the Fretwork Section had the idea of making signs for houses, and he has found it very profitable. A Visit to the General Post Office, Birmingham, proved exceptionally interesting, and members enjoyed rides during a Visit to the Garden Railway of Mr. W. Rock, at Aldridge. Club roll: 25. *Secretary:* A. L. Morgan, 17, Cobden Street, Fallings Heath, Wednesbury.

Barnard Castle M.C.—One Meccano enthusiast, working on information found in an old issue of the "*M.M.*," has built an automatic tripod for a box camera. This tripod delays the taking of the photograph for a few seconds after the camera has been set, and enables the photographer to include himself in the picture. Hornby Train working also has been carried out. Club roll: 11. *Secretary:* S. W. Telfer, The School, Barnard Castle, Co. Durham.

St. Stephens (Saltash) M.C.—There has been a large increase in membership in the Junior Section, which has been chiefly engaged in making a peep-show of model aeroplanes. The Model-Building Section have been concentrating upon models of Millbay Station, Gatwick Airport, and the several battleships and aeroplanes under construction. Games have been played for a short time at each meeting. Several members of the Plymouth M.C. visited the club recently. Club roll: 10. *Secretary:* B. Braund, 9, Homer Park, Saltash.

Winchmore Hill Collegiate School M.C.—A pleasantly varied programme has been carried out, the most interesting feature of which was an outing to Southampton to inspect the Cunard White Star liner "*Queen Mary*." At the time of the visit the great liner was in dry dock, and the party were interested in her mighty propellers. One of the ship's stewards conducted the party over the ship. A Model-building Advisory Committee has been formed to aid members in making their Exhibition models. At a recent meeting a Question-and-Answer Competition concerning Meccano Mechanisms was held. A presentation has been made to Mr. E. Essex, who has resigned the Leadership of the club owing to leaving the school. Club roll: 36. *Secretary:* J. A. Piejus, 22, Woodland Way, Winchmore Hill, N.21.



Officials and members of the Winchmore Hill Collegiate School M.C. In the back row Mr. K. Temblett Wood, President, is on the extreme left, and Mr. E. Essex, until recently Leader, is on the right. J. A. Piejus, secretary, is supporting the framed club certificate. Model-building is exceedingly popular, as the photograph shows, and there are strong Hornby Train and Model Aeroplane Sections.

AUSTRALIA

Maylands M.C.—Six new members have been enrolled. A Jumble Sale organised by the Extensions Committee realised £4/15/7, and part of this sum has been spent on material for a storage cabinet for the club stock of Meccano Accessories. Another interesting recent event was an Airports display, when the honours for the best show were won by the Green and Gold Faction, who built a splendid miniature Hendon airport. A novel feature of their display was a cleverly-made model of a pilot's cockpit complete with instrument panel and other control equipment. The Red and Blue Faction built a fine model of Croydon airport, which they made very realistic by extinguishing the club-room lights and directing a searchlight and several floodlights upon the model. "Commentators" described various activities, and a night attack by air provided a thrilling climax. Club roll: 31. *Secretary:* A. Thomson, 13, Kennedy Street, Maylands, W. Australia.

Thebarton Technical School M.C.—The membership has been steadily increasing, and many interesting meetings have been held. A Visit has been paid to the laboratories of F. H. Faulding and Company. A Lecture on "*The Bass Strait Cable*" by the President was greatly enjoyed, and an interesting talk on "*Punishments of the Past*" has also been given. Several of the members are constructing a model loom. This model was first built several years ago, and proved a great success. Club roll: 70. *Secretary:* B. S. Clarke, 21, Victoria Street, Glandore, S. Australia.

CANADA

Rosemount (Regina) M.C.—The Annual Exhibition of Meccano working models was held at 2329, Eleventh Avenue. It was open for three days, and attracted many visitors. The great variety of Meccano models included many fine engineering ones, the largest being a giant block-setting crane over 5 ft. long that traversed a track 10 ft. long. A very popular feature of the Model Railway section was a scale model C.P.R. passenger train operated over a 20 ft.-length of track. The club Museum has been considerably enlarged, and recently a fine collection of over 1,000 Indian arrow-heads was added to it. *Secretary:* J. Watson, 974, Athol Street, Regina.

EGYPT

Cairo M.C.—Meetings have been held regularly, and members show great interest in the programmes arranged. The club Correspondence Section is very flourishing, and letters are received from all parts of the world. The Leader recently gave a third talk on how correspondence between people of different countries helps in establishing good relations between them. Club roll: 30. *Secretary:* Sayed Fahmy Awad, 7, Atfet El Zawia, Haret El Gameh, Shoubra, Cairo, Egypt.

HOLLAND

Maastricht M.C.—Members have been busy constructing aeroplane models for a club Competition. Attention is now being concentrated on preparations for an Exhibition, and every effort is being made to ensure that it will be a great success. The Exhibition will be in three sections, devoted to Meccano models, a Hornby Railway and fretwork models, and aeroplane models respectively. The club Correspondence Section is flourishing, and members are in regular touch with boys in Canada, Australia and Scotland. Club roll: 36. *Secretary:* L. Mulders, Houthemerweg 20, Meerssen, bij Maastricht, Holland.

SOUTH AFRICA

Malvern M.C.—A visit to the Central Fire Station was greatly enjoyed. Many excellent models were constructed at a recent Model-building meeting, and included breakdown vans, jib crane, windmill, sleighs, and a cream whisk. Club roll: 68. *Secretary:* C. Courtis, P.O. Box 8, Cleveland, South Africa.

Observatory and District M.C.—A splendid Models Display was held in the club-house, 45, Station Road, Observatory, the members having been invited to bring models made out of any material they liked. The Senior Section exhibits included some excellent Meccano models, and a waterline model of a motor boat at speed. A novel entry in the Junior Section was a realistic model of a volcano in eruption, and another interesting item was a motor-car greasing ramp. *President:* Mr. G. E. Barrett, P.O. Box 1247, Capetown.

Pioneer M.C.—A Model-Building Competition attracted many excellent entries in three classes, for models built of 100, 50 and 25 parts respectively. The President entertained the club at a Birthday Party given by him, and the club presented him with a birthday gift. No meetings were held during July owing to the holidays, during which some of the members hiked to Durban and back. An ex-Meccano boy has kindly sent the club a parcel of Meccano Parts. Club roll: 11. *Secretary:* A. H. Alley, 461, Burger Street, St. Pietermaritzburg, Natal.

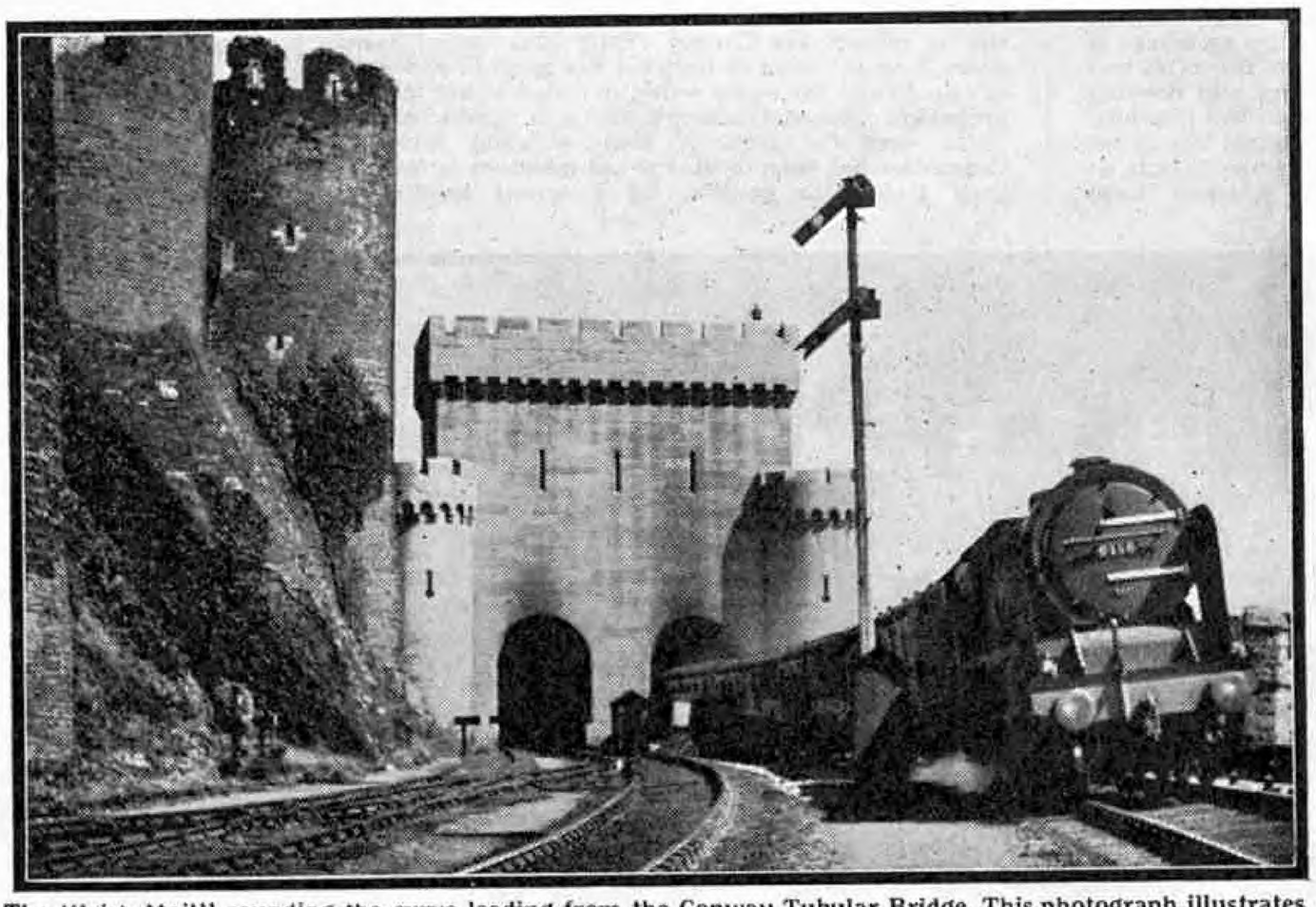
Why Trains Heel Over

The Canting of Railway Tracks on Curves

THE train in the accompanying illustration appears to be leaning over at almost a dangerous angle. There is nothing wrong with it, however, nor with the track on which it is running. The train is passing round a curve, as is evident from the photograph, and the heeling-over effect is due to the raising of the outer rail of the curve. This raising is known technically as super-elevation, or "cant."

Owners of Hornby Railway Outfits will have noticed that their curved rails are provided with sleepers that raise the outer rail of the track above the level of the inner one. The purpose of this is to overcome the tendency that the train has to "keep straight on," and fly off the rails, when running round curves at high speed.

In real railway practice the same tendency on the part of the trains makes it necessary for the engineer, in laying and maintaining curved lengths of track, to see that sufficient super-elevation or cant is given to the outer rail. This is effected by packing up the ballast under the sleepers to the required extent. The illustration on this page shows this packing up of the ballast in a striking manner. On the inner side of the curve of the unoccupied track the ballast is little higher than the formation level, but on the outer side the edge of the ballast forms quite a "bank."



The "Irish Mail" rounding the curve leading from the Conway Tubular Bridge. This photograph illustrates in a striking manner the cant of both up and down tracks. Photograph by courtesy of the L.M.S.

When two trains are passing each other on a canted curve the super-elevation gives a very curious impression to the traveller looking out of the window on the "off" side, that is the one adjacent to the other track. If he is looking towards the inner side of the curve, the train passing him seems to be much higher up than the train he is in. Exactly the opposite impression is received if he is looking towards the outer or super-elevated side of the curve.

The amount by which the height of the outer rail should exceed that of the inner rail depends on the speed of the trains and the radius of the curve. The actual amount is frequently a compromise, however, for the super-elevation required for the fastest trains will be too great for the slower passenger and goods trains, which will be hindered rather than helped by excessive cant.

Speed reductions are sometimes necessary over curves that are particularly sharp, even though they are properly canted, and the special high-speed trains of the L.M.S. and L.N.E.R. have to slow down on curves that can be negotiated without reduction by ordinary expresses. The speed of trains also has to be reduced through junctions, where normally there is no cant because of track intersections and connections. An article in the January 1934 issue of the "*M.M.*," entitled "Railway Speed Restrictions," dealt with speed reductions of this kind. A system of introducing super-elevation at junctions has been developed recently on the L.M.S., however, in order to allow of higher speeds and smoother passage through junctions. An important feature in this introduction is the use of special chairs having different rail levels that give varying degrees of cant to the diverging rails.

The super-elevation of the outer rail is not commenced suddenly at the beginning of the curve. It begins a short distance away, and matters are arranged so that it reaches its full value gradually, thus assisting trains to negotiate the curve without any violent shocks. For the same reason the straight track and a circular curve are linked as far as possible by what is known as a "transition curve." The radius of this increases continuously from zero at its point of commencement on the straight until it reaches that of the circular part of the curve. This eases the approach to the curve considerably, as the train is led gradually from the straight into the curve. Where such approaches are possible the cant is increased progressively throughout the length of the transition until the maximum is reached and then maintained at the circular part of the curve.

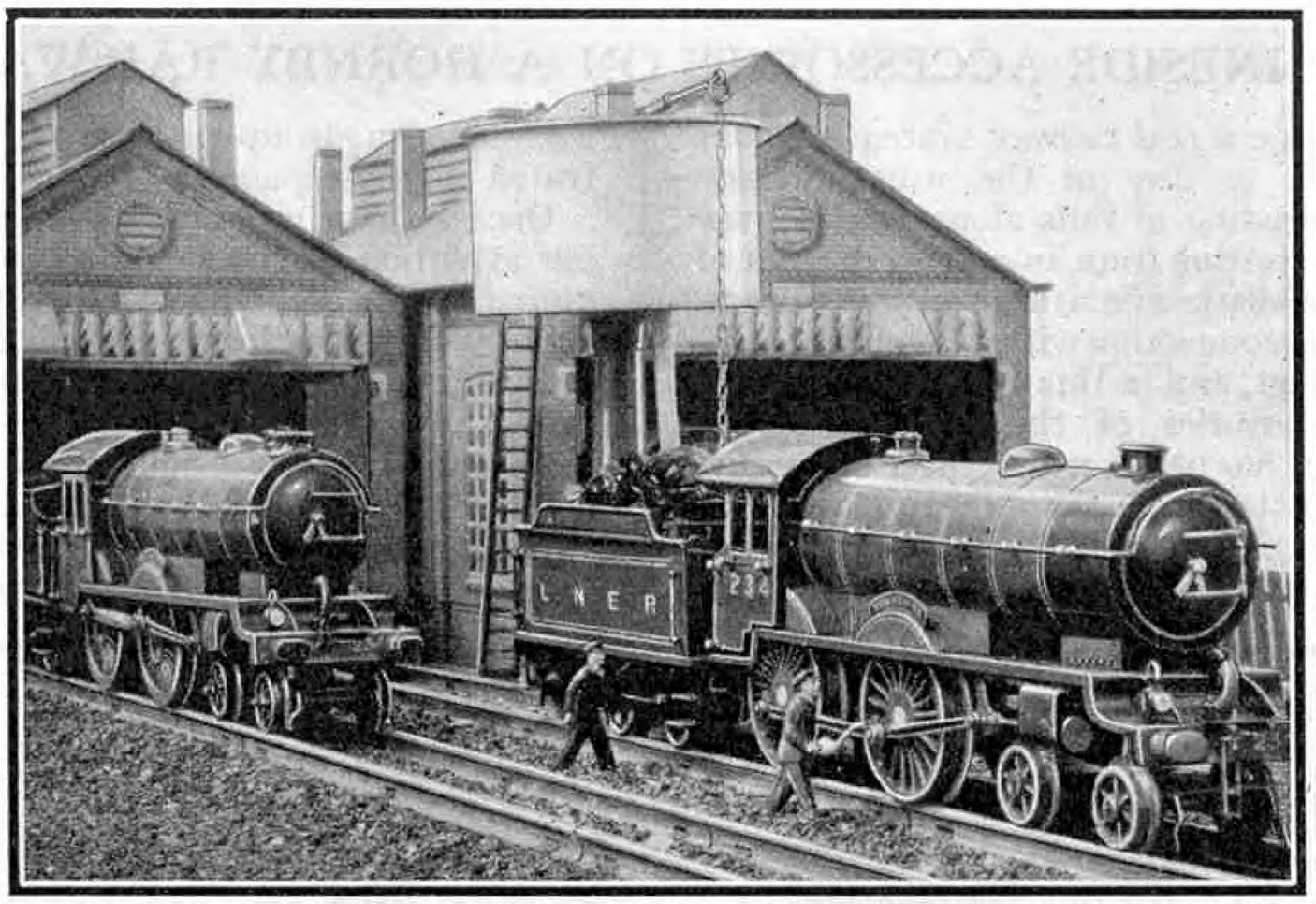
For the sake of safety, and in order to ensure smoothness of travel over canted sections of the line, it is necessary that the track should be well maintained by the permanent way staff. The correct degree of curve and super-elevation must be preserved throughout. The technical staff of District Engineers therefore regularly survey curves and set out alignment and level pegs for the guidance of the ganger and his men. Permanent small "monuments" or posts are now frequently placed alongside the track. From these the alignment of the curved length can be checked and corrected as necessary by the gang in the course of their regular duties.

A Useful Hornby Layout

Developing the Oval to give More Fun

THE layout illustrated on this page is particularly interesting because it shows how a plain oval can be built up into a system capable of very realistic and fascinating working. It was designed to occupy a space measuring 11 ft. 9 in. by 6 ft. Stations are not shown, as their positions can be varied to some extent.

The main line is an oval that incorporates an S-shaped return loop running from one side to the other. Running parallel with the lower side of the oval are two dead-end tracks that join up with the oval by means of points in the lower left-hand corner. These two dead-end tracks can be considered as serving the passenger terminus of the railway. One of them, the lowest on the diagram, has an extension that reaches round to the top left-hand corner of the layout. This extension can be used as a siding for the storage of rolling stock, as its situation allows vehicles to be worked on to the lower or departure line of the terminus quite easily.



An Engine Shed scene on a Hornby Railway. The Driver, Dinky Toy No. 1D, is busy oiling round his locomotive before it commences its day's work.

Accommodation for the locomotives is provided by the other siding on the left-hand side of the layout. The points connecting this line to the main oval are situated in such a manner that engines can be worked between either of the platform roads and the engine line without difficulty. If it is necessary for a locomotive to run directly on to the main line this also can be done quite easily.

The goods yard is situated some distance away from the locomotive department, but there is really no objection to this. Light engine working will certainly be necessary, but this is frequently so in actual practice. In any case the ease with which the engines can reach the main line makes up for any light running.

A train can commence its journey from the departure line in the terminus and when once on the main line it can make as many circuits of the main oval as required. If a wayside station is situated on the lower side of the main oval, stops can be made there according to the working timetables.

When it is necessary for the train to complete its journey use is made of the "return loop." A train can enter the loop at either end by means of right-hand facing points and when the main line is re-joined the effect of the loop is to reverse its direction of travel. It is thus possible for the train to end its run in the terminal station from which it started, and possibly the inner line of the two will be reserved for arrivals. This return to the actual starting point is often necessary in miniature practice, and makes a certain amount of imagination necessary when trains are being run from point to point.

Numerous variations of the same general running arrangements are possible and the keen Hornby Railway owner will soon try out many of them. The return loop can be used at any time during the journey. Thus the train could run over this route right at the start if preferred, and several stops at the wayside station could be made both before and after the train had traversed the return loop.

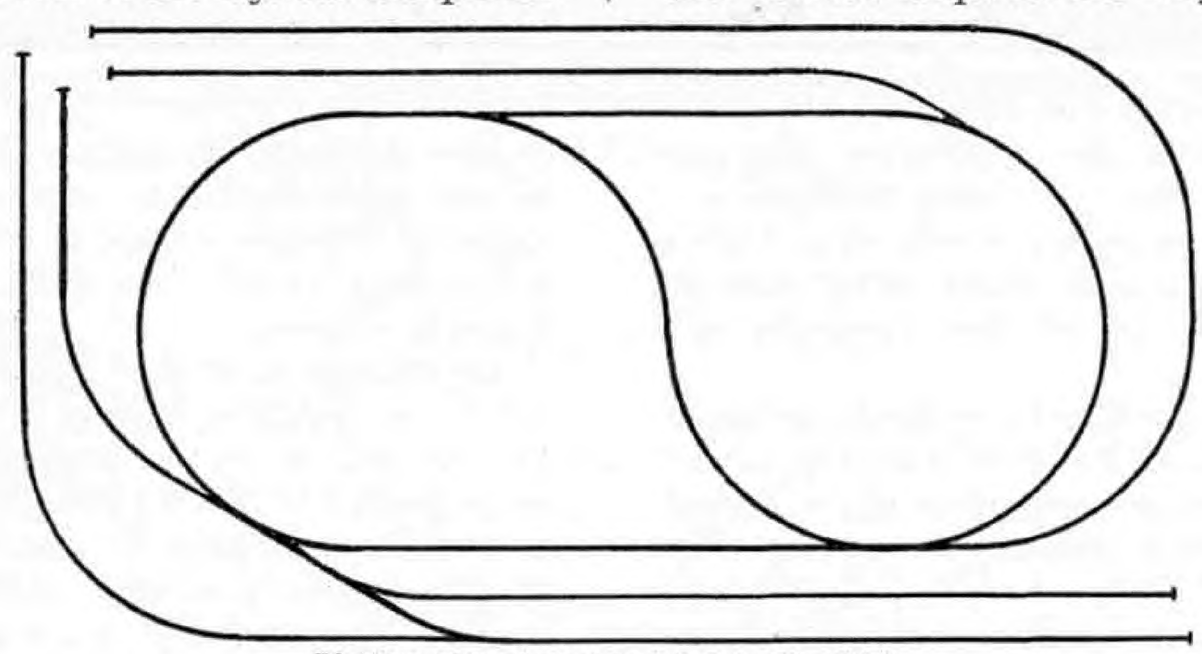
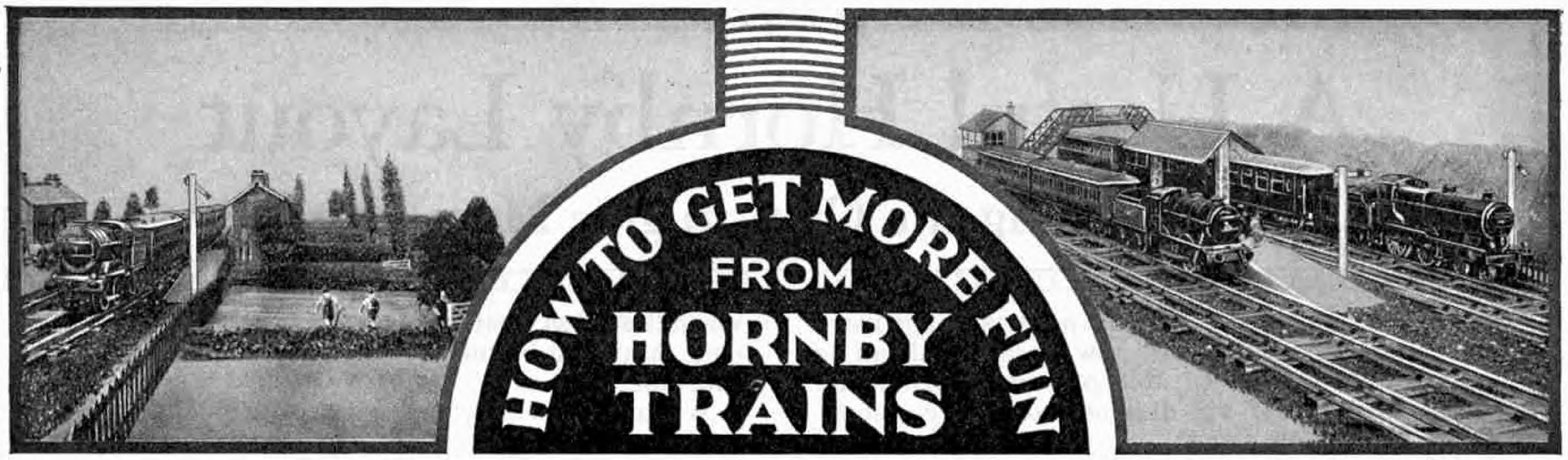


Diagram of the layout described in this article.

The loop is also particularly useful when trains that have arrived at the terminus have to be disposed of and made ready for the next journey. Another locomotive can be used to draw the train away, thus releasing the engine that brought it in, and this relieving engine is known as a "turnover" locomotive. If no turnover locomotive is available the train must be backed out of the station, an operation that always seems to arouse interest, whether in actual practice or in miniature. The train is pushed gently on to the main line, through the return loop, and back into the station. It is reversed in the process, so that the engine is now in the correct position at the head of the train and ready for another journey.



LINESIDE ACCESSORIES ON A HORNBY RAILWAY

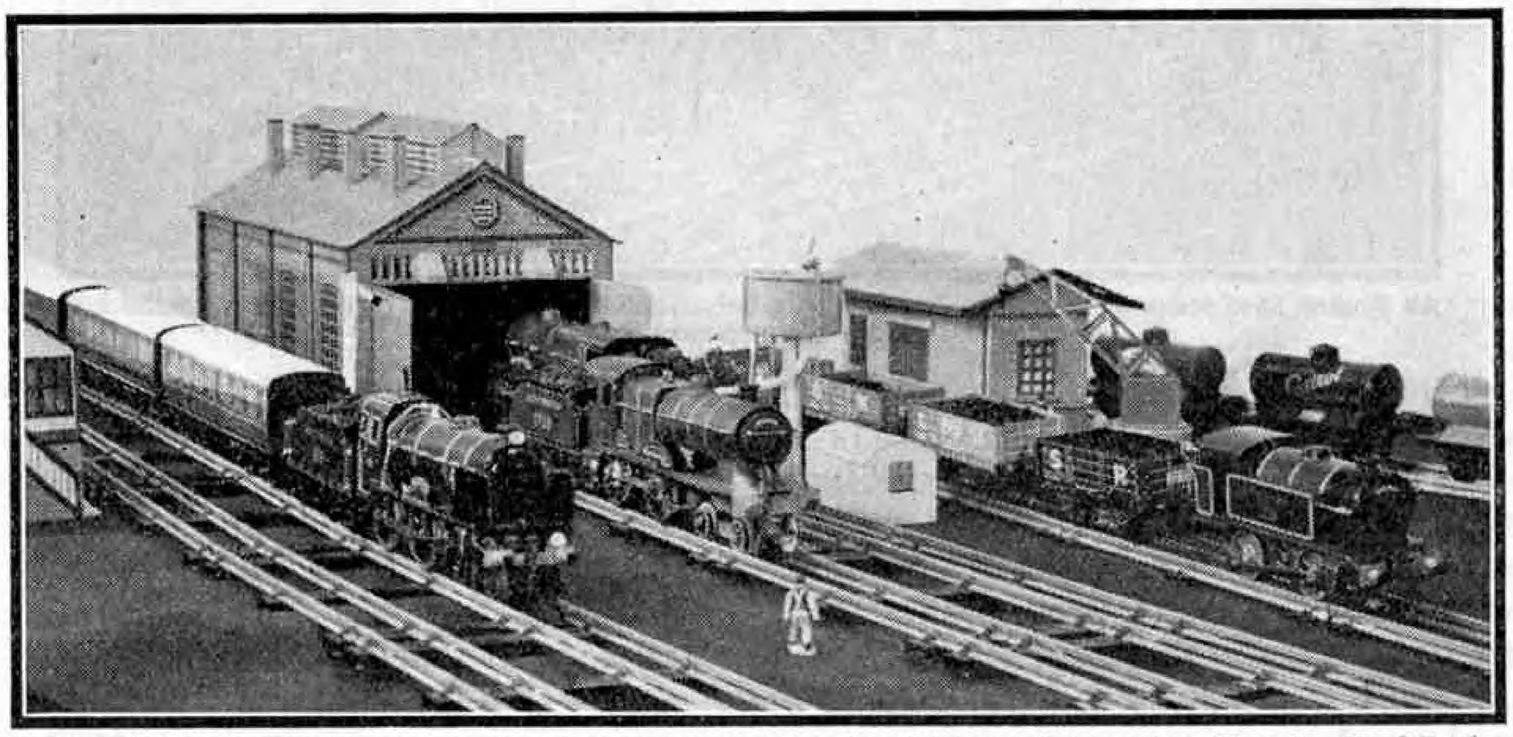
IT is difficult to imagine a real railway system without any stations, signals or any of the usual lineside features. A layout consisting of rails alone can be very intricate, and quite interesting from an operating point of view, but it is not a realistic miniature railway system. The use of accessories in connection with a layout is therefore an important subject, and in this article we will deal with the various accessories of the Hornby Series.

Once the track layout has been settled, the first important addition must be a station, if the railway is really to serve the district through which it is supposed to pass. The trains must have somewhere to start from and somewhere to stop; otherwise they cannot provide the service that is the reason for the railway's existence! Hornby Stations are realistic in design, and the more elaborate types are arranged so that the platforms can be extended in length by the addition of the separate Passenger Platform sections. Several of these Passenger Platforms also can be used together to make a plain platform without any buildings. Such a platform can form one side of a double road station, the main building and offices being situated on the No. 1 or No. 2 Station on the opposite side of the track.

There is also the useful Island Platform. Its purpose, as suggested by its name, is to lie between two tracks, an arrangement that is sometimes necessary on a layout where the width available for a station is restricted. The Island Platform can be used alone, between the up and down tracks, or along with the Stations previously mentioned to form the centre part of a four-road station. It can be extended in length by means of the Passenger Platform. The Paled Fencing normally used on the Passenger Platform is detached when this is done.

In addition to the usual types of passing stations, terminals also can be arranged with Hornby Station components. Passenger or Island Platforms can be used, the actual terminal end and "circulating area" of the station being formed by the centre unit of the No. 2 Station. Terminals made up in this way have often been illustrated in these pages.

Once we have provided for our passengers we must turn our attention to goods traffic. Sidings and yards are required for the accommodation of the wagons, but a goods depot is necessary for the loading of freight and as a centre for distribution by road motor services. Of the two types of Hornby Goods Platforms, the No. 2 is the larger and more imposing. As its name implies, it consists of a goods loading "bank" or platform, and is fitted with a revolving crane. This is very useful for handling goods, and adds considerably to the realistic appearance of the station. At the other end of the platform is a goods shed or warehouse fitted with sliding doors, in which miniature freight can be stored when necessary. The No. 1 type of Goods Shed is similar, but slightly smaller and has no crane, nor do its warehouse doors open.



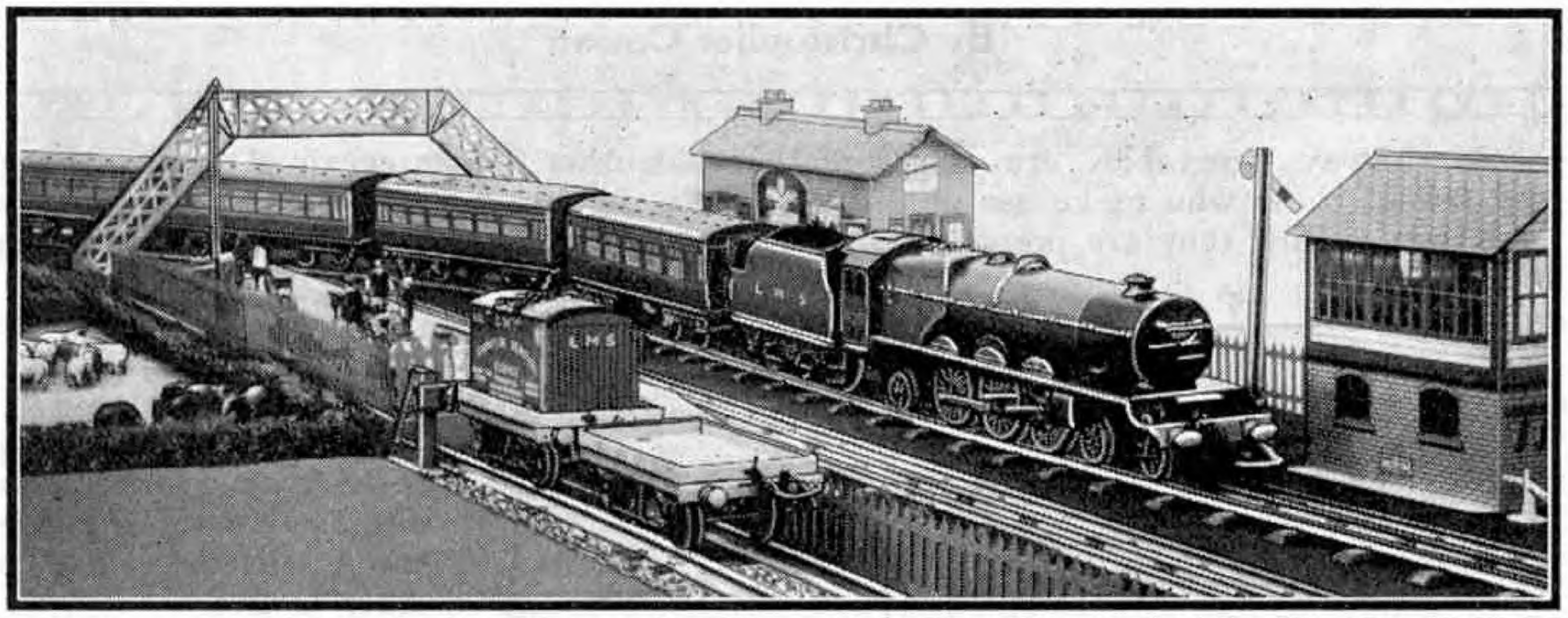
Various Hornby Accessories are shown in this photograph of part of a miniature railway system. There is a No. 2 Engine Shed in the background and on the right-hand side of the illustration is a No. 2 Goods Platform.

In the goods yard a loading gauge is a most important item. Its purpose is to show the limit in height of the loads that can be accepted on the line. The two types of Hornby Loading Gauges are interesting accessories that closely resemble the real ones, and one of them is necessary in any goods yard.

An important item is the housing of locomotives when not in use. Hornby Engine Sheds are ideal for this purpose and several types are available. The illustration on this page shows the No. 2 Shed, the most popular type, and its realistic appearance is clearly shown. All the Hornby Engine Sheds have two tracks and double doors. Apart from their practical purpose in keeping the engines under cover and free from dust, they are very useful from the spectacular point of view. They are relatively large buildings, and any of them makes quite an imposing addition to a layout. The locomotive depot should be easily accessible from the main station, so that the engines can move freely in and out of the shed without a lot of reversing movements.

An obvious addition in connection with the Engine Shed is a Water Tower, and one is prominently displayed

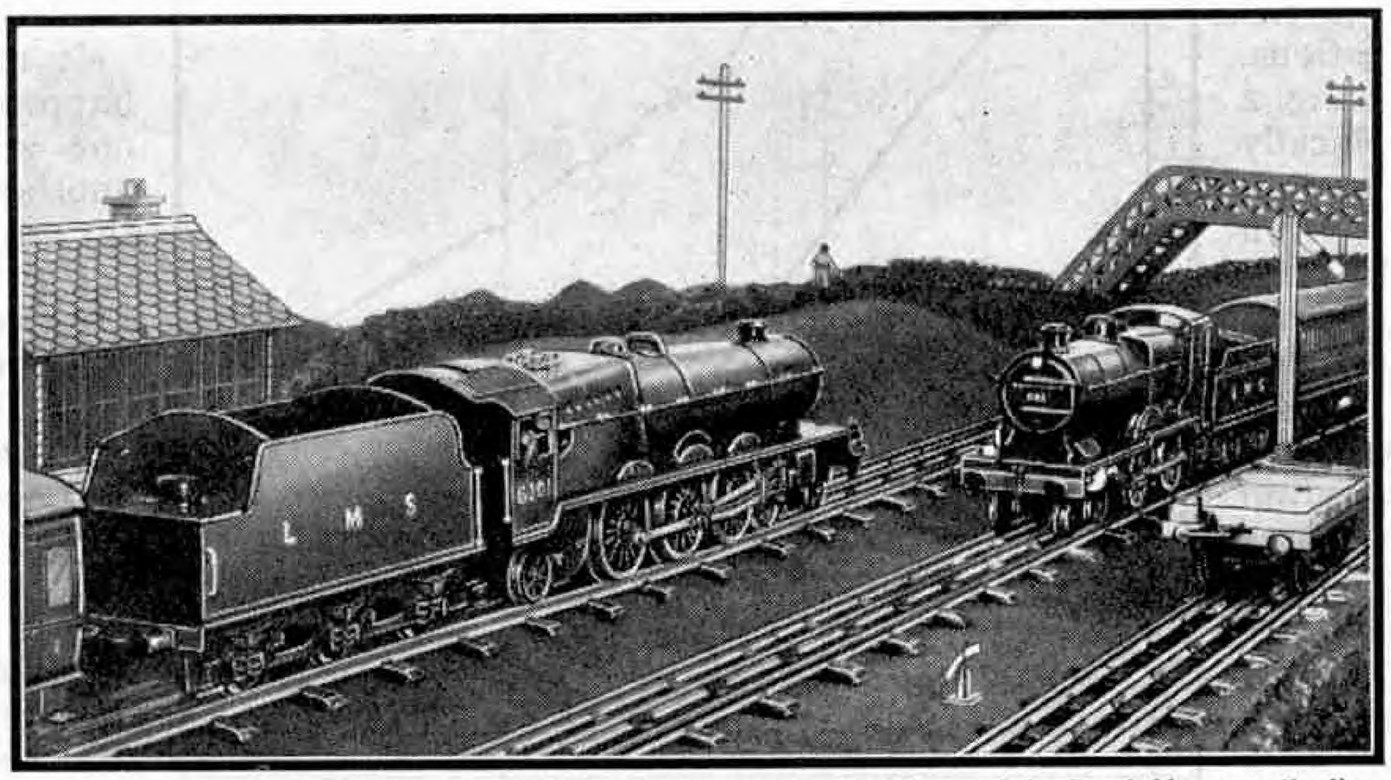
in the photograph previously referred to. There are two types of Water Tower in the Hornby Series, both of which add greatly to the realism of a model railway. These accessories can also be placed in goods sidings where a great deal of shunting is carried on, in order to avoid the necessity of sending the engine to the Shed every time its water supply has to be replenished. Another possible position for a Water Tank is at the end of station platforms, so that station stops can be made use of by the enginemen for watering purposes.



An L.M.S. express hauled by the Hornby 4-6-2 Locomotive "Princess Elizabeth" passing a wayside station. The station is arranged as suggested in this article, and good use is made of the Signal Cabin, Footbridge, Paled Fencing and other accessories.

The correct use of signals on a model railway adds considerably to its interest, and the "scenic" effect of well-arranged signals is very pleasing. The Hornby Signals include both "home" and "distant" types. Some of them can be obtained fitted for operation by means of the Hornby Control System. This makes it possible to work both Signals and Points from a lever frame in a signal cabin exactly as is done in real practice. There are two kinds of Signal Cabins for Hornby Railways, and of these the No. 2 is made to accommodate the Lever Frames of the Control System. It is also fitted with a hinged roof to allow the levers to be operated easily.

Buffer Stops are necessary to complete any dead-end tracks. The Hornby No. 1 Buffer Stops represent the type in general use on real railways. They are particularly intended for ending sidings and are also useful in smaller terminal or branch line stations. The No. 2 Buffer Stops are modelled after the larger hydraulic types used in most important terminal stations. They add greatly to the realism of a terminal station that is made up in the manner suggested previously in this article. Like their real counterparts, they are very effective in stopping an "over-zealous" locomotive.



An effective scene in the "open country." The Telegraph Poles, Hedging and the Footbridge over the line make this section of the line most realistic.

The lighting of railway yards and premises generally is important, for the railways are busy throughout the whole of the 24 hours, and some traffic centres are busier even by night than by day. Lamp Standards therefore should be included in yards and in the neighbourhood of stations on a miniature railway system. These accessories always look well, even if they are not arranged to light up. While on the subject of lighting it is necessary to point out that many Hornby Accessories can be obtained fitted for electric lighting. It is very fascinating to operate a railway when these are in use; the characteristic red or amber and green lights of the signals that are fitted with electric lighting is particularly pleasing.

Paled Fencing is very useful for skirting the side of the track, and also for marking out fields and roads. Where roads are included they will require to cross the railway by means of a Level Crossing. The No. 2 type of Level Crossing is fitted with two tracks for use on a double-track railway. With its four white painted gates it is very handsome in appearance. The No. 1 Crossing is smaller, with single gates and is made for sections where single track is employed. At the side of the line a Platelayer's Hut makes a welcome break when long stretches of line through the "open country" occur. The Watchman's Hut with its Brazier also looks very well, and is most suitable for winter use when fogs may occur frequently. Gradient posts and mile posts should always be included, for they help to give a railway-like atmosphere to the layout.

Tunnels are necessary features, and can be obtained for use on straight lengths and also on curved lengths of track. They look very well when used in conjunction with the sectional Cuttings. These Cuttings are made up in three sections, two end pieces and a centre piece. The centre section can be extended by simply placing the required number of pieces end to end. The cutting bank is then completed by the use of end pieces.

For those who require them there are complete Cuttings, both sides of which are fixed on a base over which the rails can be laid. Railway footbridges are important to most boys, if only because they make such good spots to see the trains from! All model railways therefore should include at least one of them. There are various Footbridges in the Hornby Series, and of these the No. 1A type is the most popular of the three, as it is fitted with two signals.

Common sights from the window of a railway carriage are advertisement hoardings, usually in fields, but also seen on station platforms. These add considerably to the railwaylike appearance of a model railway. The Hornby miniature hoardings are very realistic, and various Posters are available for use on them.

Preparing a Railway Timetable

How the Paths of Trains are Worked Out

By Christopher Cowan

TO many people railway timetables are complete mysteries, and few of those who make use of them regularly have any idea of how they are prepared. The figures in them and on the time sheets of the railway companies represent a state ot constant activity all over the system, for they give a complete record of the movements of every regular train.

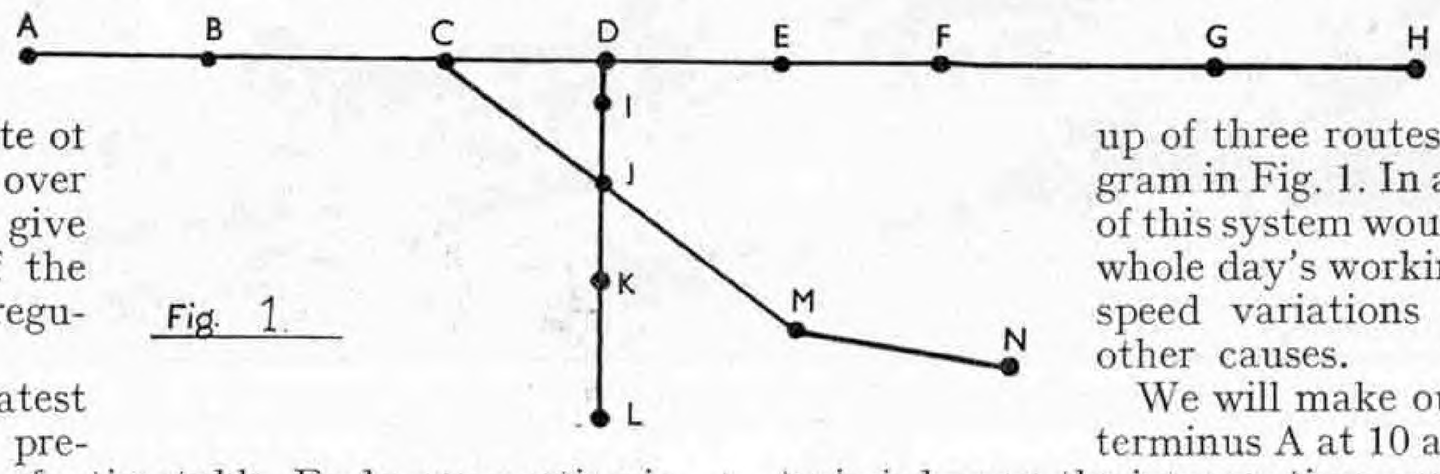


Fig. 1

Naturally the greatest care is taken in the preparation and printing of a timetable. Early preparation is necessary, for a single change in the timing of one train may necessitate the alteration of connecting services throughout the greater part of a system. Suggestions from the public for an altered or additional service here or there have to be weighed up. The possibilities of the better use of locomotives and coaching stock without impairing the service afforded must be considered; also any new or special features that are to be introduced.

The "path" of each train has to be worked out with its correct timing at every point of importance, such as signal cabins, junctions and stations. This is done by preparing a chart, which shows graphically the path of each train so that its position at any given moment can be seen. How this is carried out can be seen by reference to the accompanying illustrations.

Fig. 1 shows an imaginary railway system in diagram form. This consists of three lines, A to H, C to N, and D to L. We will suppose that we have to arrange for the running of five trains over this system, and in order to keep things as simple as possible we will deal with down trains only. Our first train is to be an express from A to H, stopping only at the junctions C and D. In connection with this there is a branch train from C to N, and this connects also with another train from J to L. The other two trains are a stopping service from A to N, and a connecting service from C to H.

In order to show graphically the movement of each of these trains we prepare a chart as shown in Fig. 2. On this the various stations of each route are shown vertically, and are spaced proportionately to their distance from each other. The intervals of time are marked off horizontally. In this case three hours will be sufficient. It will be noted that the graph is really in three separate sections. This is because our imaginary system is supposed to be made up of three routes, as shown in the diagram in Fig. 1. In actual practice a graph of this system would be enough to show a whole day's working, together with local speed variations due to gradients or other causes.

We will make our first train leave the terminus A at 10 a.m. If the speed of the train is known the journey time can be calculated, having regard to conditions on the route, and the appropriate arrival and departure points at the junctions C and D can be arrived at. These points are now connected, and the line marked "No. 1" shows graphically the working of the trains. As the connecting trains from C to N and from J to L run over different sections of the line they cannot be shown on the same diagram. Trains "No. 2" and "No. 3" therefore are shown on separate sections of the chart, each distinct run having a separate section. Thus if there had been 20 branch lines, we should have needed 20 sections to our graph.

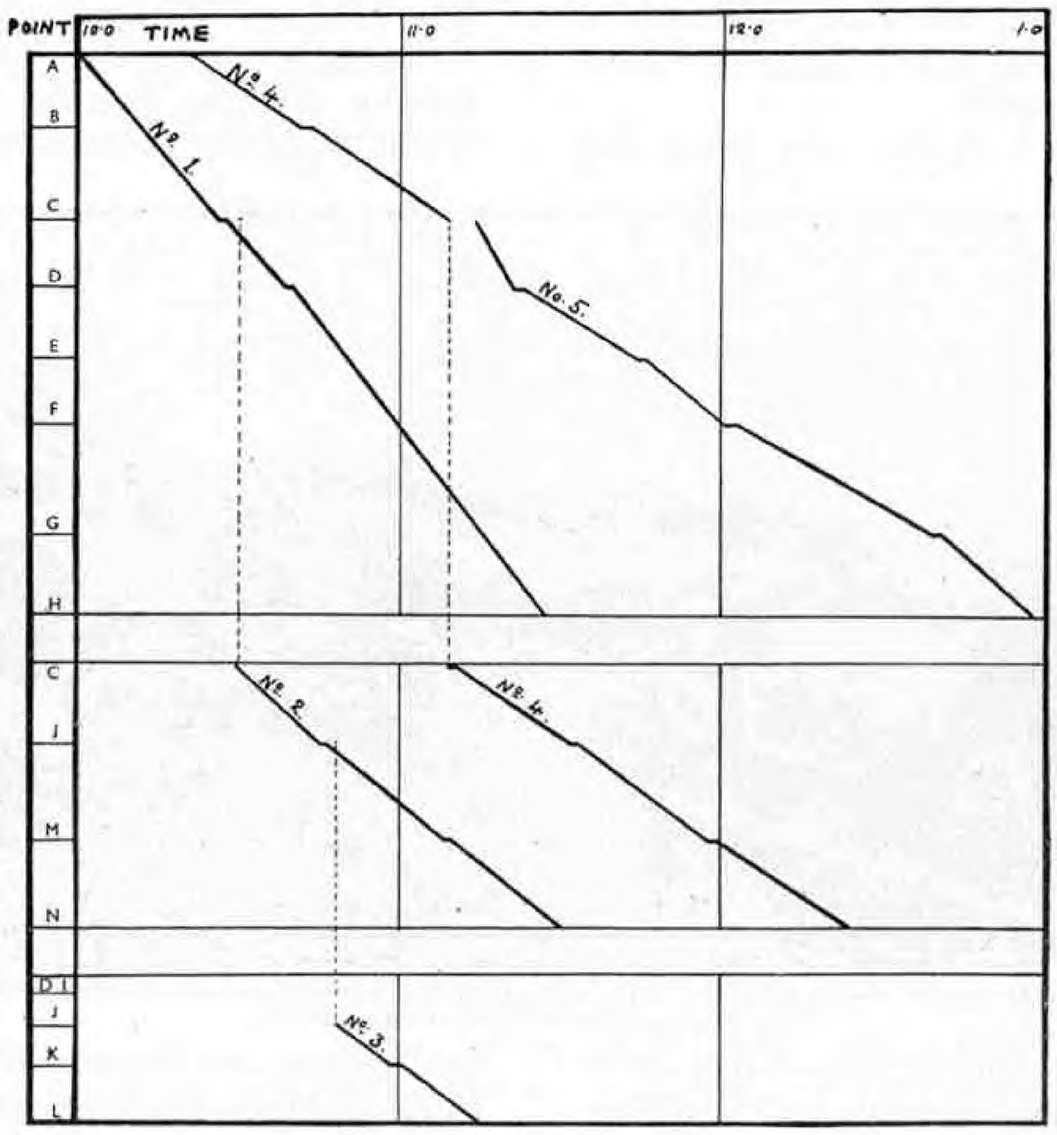


Fig. 2. The chart on which are plotted the paths of down trains on the railway shown in Fig. 1.

It may be wondered what happens when a train leaves one section of the line for another. This is indicated on the graph by a dotted line from one section to another, joining the two corresponding points. Thus train "No. 4" runs from A to C in the top portion of the diagram, and reappears again in the second portion, where its path from C to N is traced. As station C is common to both lines it appears on both graphs.

After we have plotted our trains it is a simple matter to draw up a finished timetable. In plotting the times of our trains we may find two lines on the graph meeting or coming close together. It is then necessary to re-adjust our timing according to the features of the line. The great advantage of the graph system is that it shows exactly where such conflicting paths occur, and we can immediately see the effect of any adjustments.

With such a visual control of our entire system, it is a simple matter to arrange for special trains, or duplicate working, or any other emergency in passenger or goods traffic operation that is demanded of a busy railway.

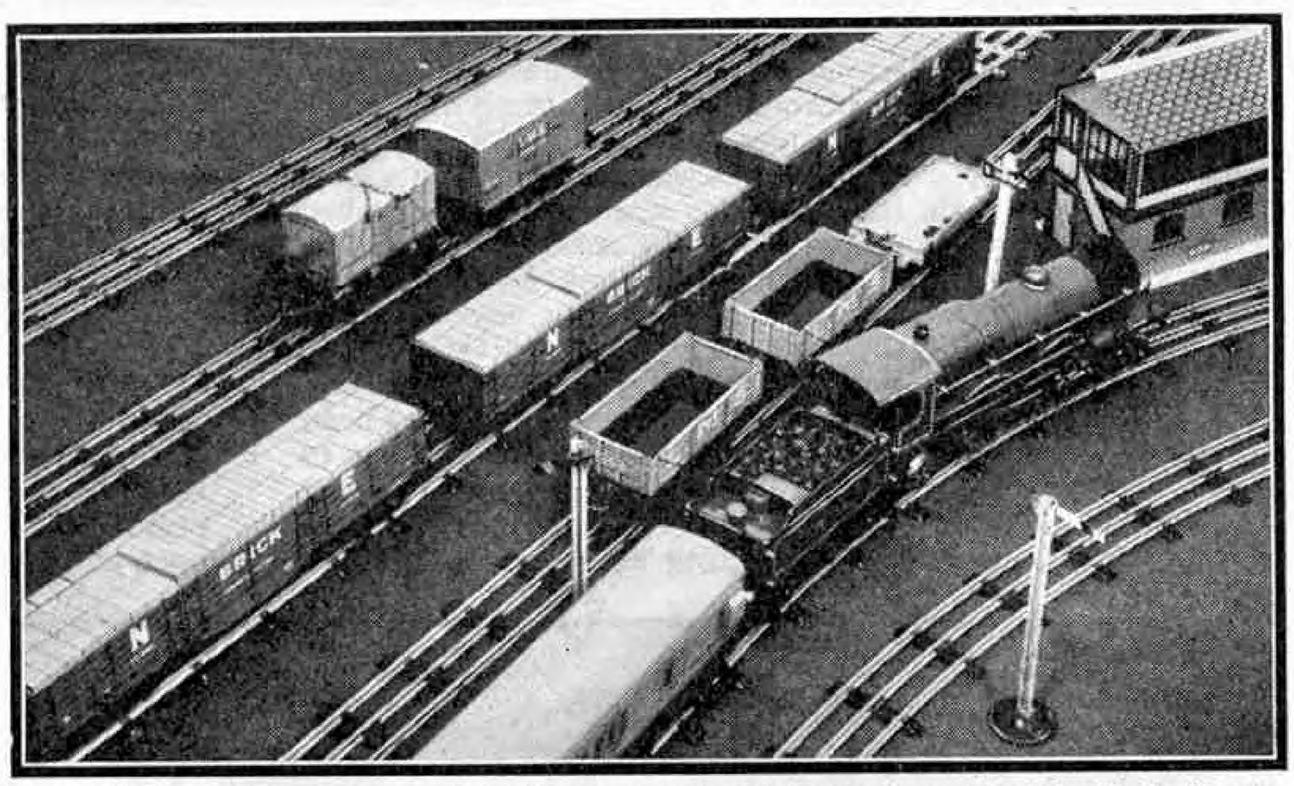
Realistic Loads for Hornby Wagons

Miniature Coal and Bricks

By "Tommy Dodd"

RUNNING goods trains on a miniature railway is made much more interesting when realistic loads are carried in the various trucks and wagons. Suggestions for making up loads have appeared in the Hornby Railway pages of the *"Meccano Magazine"* from time to time, and have been found useful by many railway "Goods Managers." Now bricks and coal have been introduced in the Hornby range, and the use of these loads for Hornby Wagons adds greatly to the fun.

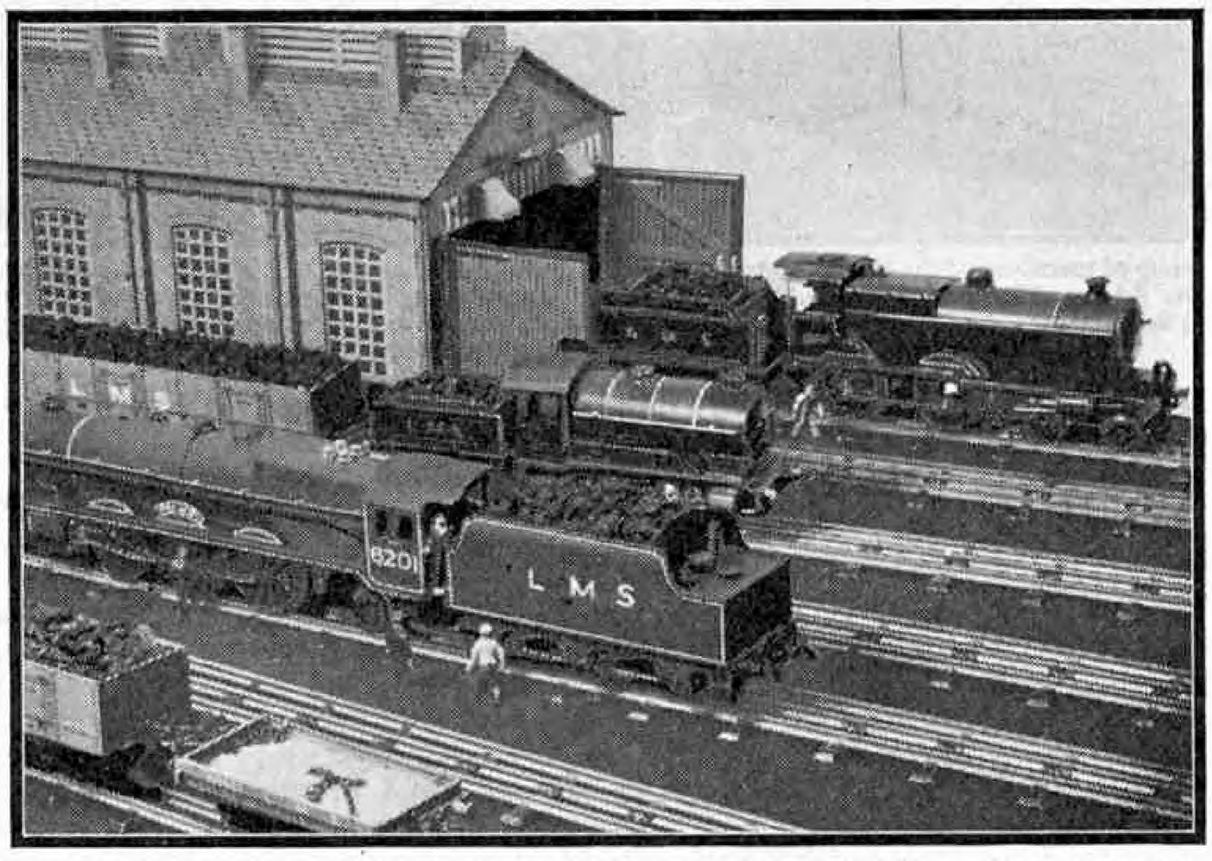
Hornby Bricks and Coal are packed in neat boxes, and an interesting point is that the lids of these are designed to fit inside the bodies of the No. 2 High Capacity Wagons. There they form a false "floor" on which the miniature load can be placed. This scheme prevents overloading of the wagons, and allows realistic effects to be obtained with a small amount of material.



The L.N.E.R. No. 2 High Capacity Brick Wagons seen in this illustration are loaded with the Hornby Bricks described in this article. The tender of the engine on the right contains the new Hornby Coal.

The new Hornby Coal is an excellent representation of the real thing. It is light in weight, and has the advantage over real coal that it is dustless, and therefore clean to handle. It is easily picked up again if it is spilled on the carpet owing to a "rough shunt" or derailment, so that possible trouble with the Domestic Authorities is unlikely! Its realistic appearance can be judged from the photographs reproduced on this page. In these it is seen in the tenders of various Hornby Locomotives, including the new 4-6-2 *"Princess Elizabeth,"* and the lower one shows an L.M.S. No. 2 High Capacity Wagon loaded with it.

Several different uses can be found for this new "mineral" on a miniature railway. The obvious one is as a load for a High-Capacity Coal Wagon. The quantity packed in the box makes a load of reasonable dimensions for one of these Wagons when it is placed on the box lid in the manner already described. There is none of the unrealistic piling that is sometimes seen when ordinary coal is used. Apart from its lightness and cleanliness already mentioned, the Hornby Coal has the advantage that the individual pieces are of fairly uniform size, and greatly superior to the out-of-scale "lumps" that are often unavoidable with real coal.



Hornby Coal loaded in locomotive tenders and in No. 2 High Capacity Wagons. This photograph gives a good idea of its realistic appearance.

Ordinary four-wheeled Hornby Wagons also can be made to convey loads of the new Coal. False "floors" of cardboard can easily be made up to suit the dimensions of these vehicles. Alternatively a genuine full load can be conveyed, and this will be necessary where the Hopper Wagon is used and it is intended to make use of the bottom-discharging doors of this vehicle in actual unloading operations.

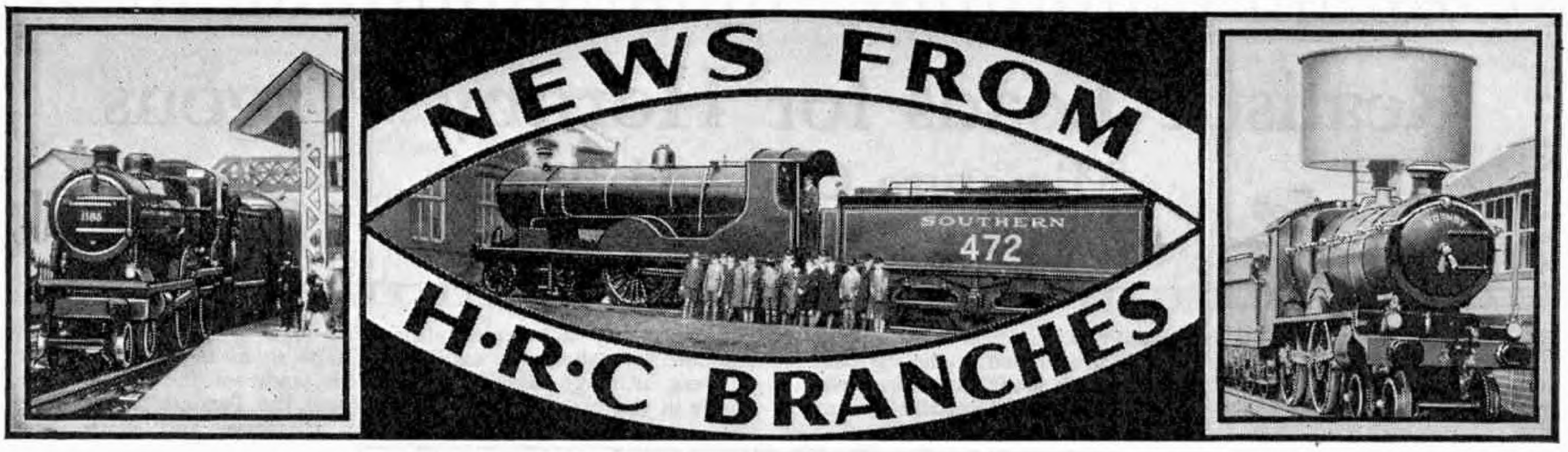
As fuel for locomotive tenders the new Coal is ideal. Full loads can be conveyed if preferred, and indeed they may be necessary if the coaling of the engines is performed by a miniature coaling plant. If only a representation of a load is required it is not difficult to make up a cardboard shape to fit in the locomotive tenders, although allowance has to be made for the shape of the tanks in the No. 2 Special Tenders and the Tenders of *"Princess Elizabeth"* and *"Eton."* No. 1 Special Tenders are the easiest of all to deal with; a layer of coal has simply to be placed on the tender.

Another use for Hornby Coal that suggests itself is in building up miniature coal stacks, similar to those often seen in goods yards and in the neighbourhood of engine sheds. A wooden block, or a cardboard box of suitable size, can be used as the body of the stack. The top and sides should be coated with glue or Seccotine, and the Coal can then be laid on and allowed to set in position. It is best to deal with each surface separately rather than to attempt to do the whole job at once, the Coal on each being allowed to set before the next surface is coated with glue.

A supply of coal is frequently to be seen near the foot of the steps of signal cabins where it is kept in a small timber or brick structure. The placing of a quantity of Hornby Coal in an upturned box lid, suitably painted, will give the correct effect on a miniature railway.

As loads for Hornby Wagons the miniature Bricks are as interesting and attractive as Hornby Coal. These Bricks are particularly intended for use with the L.N.E.R. No. 2 High Capacity Wagon. They are packed in boxes holding 100 each, and when the contents of a box are arranged on the lid, which fits inside the body of the Wagon, as already explained, they form a complete layer one brick deep, with another in the centre part of the vehicle. This arrangement is seen in the upper illustration on this page.

The bricks can be conveyed in other wagons if desired as in real practice, for brick traffic is very heavy nowadays and ordinary vehicles often are used. The Hornby L.N.E.R. Brick Wagons are the most suitable, however. They represent the type of vehicle developed on the L.N.E.R. in connection with the traffic from the Fletton brickfields near Peterborough, and this explains the instruction "Return to Fletton" that is given on the sides of the wagons. A regular service of fast freight trains for brick traffic is operated with these wagons on the L.N.E.R., and the operation of these in miniature, with the wagons loaded with Hornby Bricks, will be particularly interesting. The inclusion of a loaded Brick Wagon in an ordinary goods train also would add greatly to its realistic effect. A load of bricks stacked in the goods yard, representing a consignment just delivered, adds interest to the surroundings.



Branch News

ACTON.—Members are laying the Branch track on a wooden baseboard covered with corrugated cardboard to deaden noise. The rails are then laid on the board, the whole is painted, and finally ballast consisting of granite chippings is added. A Library and Magazine are to be features of the coming Winter Session, with Lectures, Cinematograph Shows and other forms of entertainment. Secretary: S. W. Simmons, 7, Alfred Road, Acton, W.3.

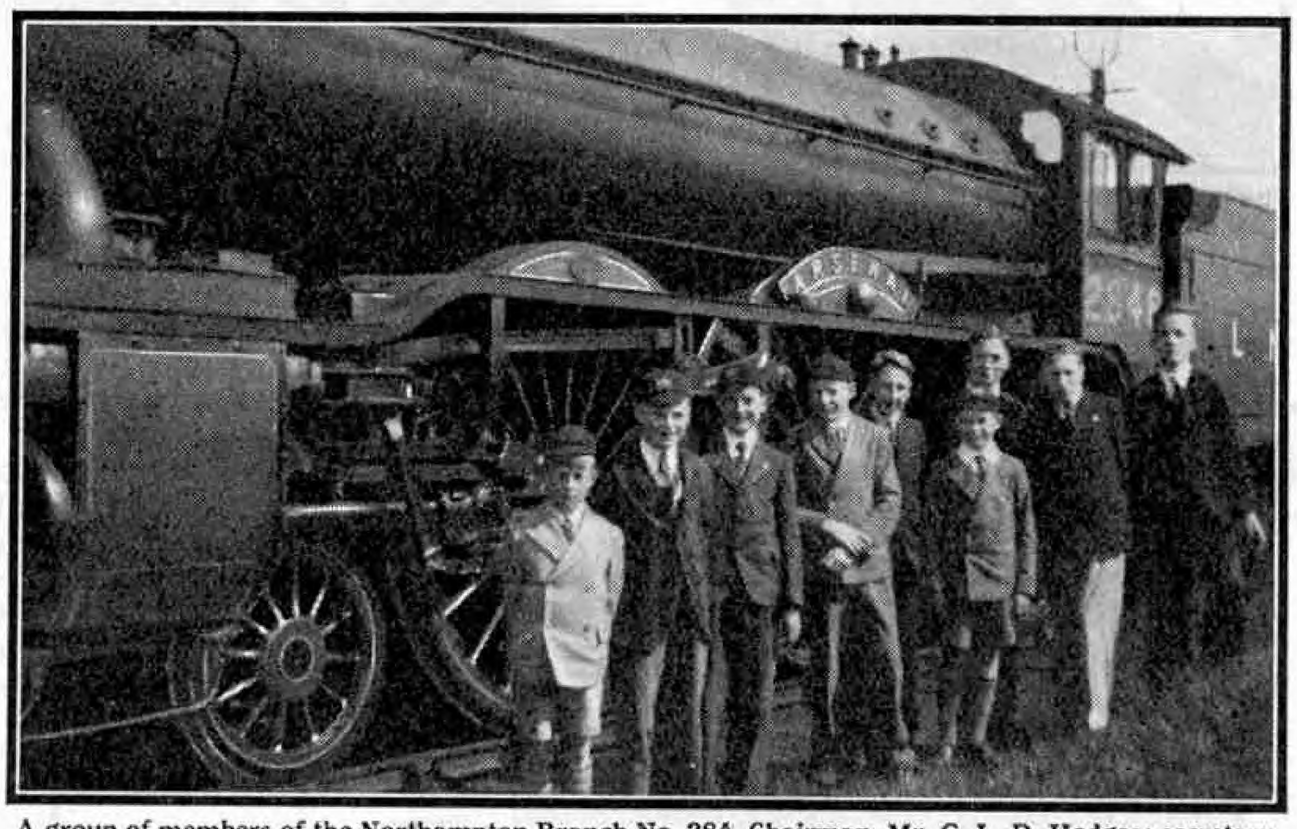
DOVER.—A new non-continuous layout has been laid down. It represents the S.R. Victoria-Dover line, with a branch line from "Folkestone Junction" to "Folkestone Harbour." The running of through expresses and branch line trains has proved extremely interesting. Secretary: D. F. E. Moore, 3, St. John's Road, Dover.

FIRST SHEFFIELD.—Outdoor activities have been the chief features of the programme recently, members spending much time watching trains at local stations, main lines and goods yards. Frequent trips have been made to other towns for the same purpose. On a recent evening excursion to Manchester, the holiday traffic necessitated the train going by a devious route, providing an interesting experience for members. At Retford members recently saw the L.N.E.R. *"Coronation"* express hauled by locomotive No. 4491, *"Commonwealth of Australia,"* and a goods express with L.N.E.R. locomotive No. 4774 of the "Green Arrow" class at its head. Further constructional work has been carried out on accessories for the Branch layout, and the main tunnel has been extended by 2 ft. Secretary: W. B. Hutchinson, 35, Linden Avenue, Sheffield 8.

ISLINGTON.—Realistic track operations have been carried out on a non-continuous layout. One meeting has been devoted to the overhauling of the track. Interesting talks have been given on *"The Making of Films," "Early Steam Engines," "London's Buses"* and *"Mountain Railways."* An outing to Southend was greatly enjoyed. Secretary: A. D. Straker, 48, Onslow Gardens, Muswell Hill, N.10.

LOSTOCK GRALAM.—Recent activities have covered a wide range. The track has been laid down to various designs, and interesting trains run. Work continues on the construction of a new model locomotive. A railway-like atmosphere has been created in the clubroom by the pasting of posters and timetables on the walls. On one occasion members watched trains on a local main line, and also saw and photographed the up and down *"Coronation Scot"* expresses, hauled by *"Queen Elizabeth"* and *"Queen Mary"* respectively. Secretary: A. Milligan, Wincham Hall, Northwich.

ST. STEPHENS (SALTASH).—Original layout designs proposed by members have been tried out, enabling novel train services to be operated. The Leader has completed additional steel rails for the layout, and is at present constructing an acute-angle cross-ing. Preliminary details are being arranged for the Exhibition to be held in November, at which local tradesmen will be invited to occupy display stands. Secretary: B. Braund, 9, Homer Park, Saltash.



A group of members of the Northampton Branch No. 284, Chairman, Mr. G. L. D. Hodges; secretary, D. K. Adams. The engine is L.N.E.R. No. 2848, "Arsenal," which members inspected during a visit to Leicester L.N.E.R. Locomotive Depot. Other activities cover a wide range, and competition is introduced in various forms, greatly stimulating enthusiasm in the Branch.

WANDSWORTH No. 1.—Timetable working has been arranged for the Branch layout, and although at the moment the track is small, it is hoped that considerable extensions will be made shortly. Special attention is being paid to scenery and lineside effects. The second issue of the Branch Magazine has been published and was quickly sold out. The finishing touches have been put to the story *"A Fruitful Exchange,"* which is to be acted shortly by members, and filmed. This is a comedy demonstrating the attraction of Hornby Trains. An extensive recruiting campaign is being undertaken for the first of the Winter Sessions. Secretary: A. H. St. L. Walker, 68a, Oakmead Road, Balham, London. S.W.

BEDFORD SCHOOL.—The majority of recent meetings have been held out of doors. Members cycled to Sandy, on the L.N.E.R. main line and saw the *"Coronation"* express. Five streamlined "Pacifics" also were observed in two hours. Two of these were hauling stopping trains while being run in, and members were able to inspect them at close quarters. Secretary: A. Coomber, 33, St. Michael's Rd., Bedford.

FOLKESTONE.—A new system of signalling is to be introduced on the Branch layout, and many signals are being constructed. Existing signals are being altered and repainted. Three new locomotives have been added to the Branch stud, including a G.W.R. 0–4–0. Secretary: W. F. Cotter, 72, Dover Street, Folkestone.

ITALY

MILAN—The weekly membership subscription introduced last March has enlarged Branch funds considerably, enabling new Hornby equipment to be acquired. As a result track operations have been carried out on a larger scale, allowing the introduction of new operations. A day's outing to Lake Lugano was greatly enjoyed by all. Several interesting books have been added to the Library. Further new gramophone records have been purchased for use at meetings of the Branch and the associated Meccano Club, bringing the total to over 300. These are of especial value when cinematograph shows are held. Secretary: E. Vigo, Corso Genova 19, Milan.

Branches in Course of Formation

The following new Branches of the Hornby Railway Company are at present in process of formation, and any boys who are interested and desirous of linking up with this unique organisation should communicate with the promoters, whose names and addresses are given below.

CAMBRIDGE—J. E. Gray, 25, Rustat Road.
BURY ST. EDMUNDS—T. S. West, 10, Crown Street.
RENFREW—T. H. Hunter, 2, Donaldson Drive.
OXFORD—J. Prescott, 6, Twyford Grove, Banbury.
BILLINGHAM—D. Wilkinson, "Greenside," Greatham.
WEST HADDON—D. Bush, Stonelea, West Haddon, Nr. Rugby.
ABERDEEN—A. Philip, 21, Camperdown Road.

H.R.C. COMPETITION PAGE

Join the Hornby Railway Company and become eligible for the competitions announced on this page.

Join the Hornby Railway Company and become eligible for the competitions announced on this page.

"MISSING WORDS CONTEST"

This month's competition is of a kind that has previously given keen enjoyment to members. In the panel on this page is an interesting account of a famous engineering triumph, from which certain words and figures have been omitted. These are represented by dashes, and competitors are invited to discover what these words are. They should have little difficulty in identifying the particular work dealt with, for there are ample clues to its nature and position. Then it will only be a question of finding the most appropriate words to fill in the spaces in the account given of it, and of filling in the figures and dates from knowledge of the engineering structure dealt with.

When competitors have found the missing words, or as many of them as they can, they should write them down on a postcard in the order in which they should appear in the account; there is no need to write out the full account.

The contest will be divided as usual into two sections, Home and Overseas. In each section three prizes will be awarded, consisting of any product manufactured by Meccano Ltd. to the respective values of 21/–, 15/– and 10/6. In addition there will be several consolation prizes. In the event of a tie for any prize neatness will be the deciding factor.

Entries should be written out on postcards and posted to reach Headquarters at Meccano Ltd., Binns Road, Liverpool 13, on or before 30th October. In the top left hand corner of the postcard should be written *"H.R.C. Missing Words Contest."* At the end of the entry must be written the competitor's name, full postal address and his H.R.C. membership number. The closing date for competitors in the Overseas Section is 31st January, 1938.

CAN YOU FIND THE MISSING WORDS?

There are many types of railway – in the world, and one of the most interesting is the – – bridge that carries both road and rail traffic over the river – –. The – authorising the building of a bridge across the river at – was obtained in –, but it was not until – years later however that tenders were invited. By the summer of – the bridge was progressing rapidly, and about one-third of its – span has been erected, but in – of that year a – occurred causing the wreck of the whole – .

After this catastrophe new – were invited and that – by the – – bridge company was accepted. The piers already constructed by the – – had to be demolished and new ones, differently situated, erected. By the end of the – season the approach arm of the north – was completed and the south – was finished in – .

The huge – for linking up the two – was built at – – about three and half miles away from the site of the bridge. When completed it was floated on a pontoon under the gap for hoisting. When it had been – about 32 ft., it collapsed, – over and fell into the river. Work was again held up while a new – was constructed. However, on – September – the – was ready and it was – to the site by – and – . After this work progressed satisfactorily and in – the first – crossed over the – and in – the structure was completed.

Drawing Contest

All boys who are interested in railways have a special liking for one engine, or for some particular class of locomotive, and no matter what friendly arguments are advanced against them, they still maintain their faith in their favourite. This month we are giving competitors an opportunity of showing their interest in their favourite engines in a Drawing Contest. In this they are invited to submit drawings of *"My Favourite Locomotive."*

Competitors may submit either pencil or coloured drawings, but the judges will not necessarily award the prizes to the senders of coloured entries.

Three prizes consisting of Meccano products to the respective values of 21/–, 15/– and 10/6 will be awarded in each section, Home and Overseas. Consolation prizes also will be awarded.

On the back of entries must be clearly written the competitors' names, full postal addresses and H.R.C. membership numbers. Unsuccessful entries will be returned if they are accompanied by stamped addressed envelopes of suitable size. Prize-winning drawings become the property of Meccano Ltd. and are not returnable. Envelopes containing entries should be marked *"H.R.C. Drawing Contest"* in the top left-hand corner, and posted to reach Meccano Ltd., Binns Road, Liverpool 13, before 30th October. Overseas entries must arrive not later than 31st January, 1938.

COMPETITION SOLUTION

June Mutilated Names Contest

The Golden Arrow
Princess Beatrice
Euston
The Royal Scot
Atlantic Coast Express
Lord Rodney
Tanganyika
The Silver Jubilee
Citadel
Kimbolton Castle
Melisande
Paragon
King Uther
Totnes Castle
Great Northern
The Flying Scotsman

COMPETITION RESULTS

HOME

August "Sharp Eyes Contest."—1. J. T. Fraser (2267), Exeter. 2. C. E. Wrayford (6039), Bovey Tracey. 3. W. Statham (54163), Birmingham.

August "Photo Contest No. 5."—1. G. H. Wood (21541), Halifax. 2. A. Donaldson (6868), Belfast. 3. S. Garbutt (30122), Altrincham. Consolation Prizes: P. F. C. Satow (54190), Ashby-de-la-Zouch; J. Rodgers (38037), Leicester; W. B. Hudson (1733), Weymouth.

Questions Contest No. 9

This contest is the ninth in this popular series. There are 12 questions which have to be answered, and they form a test of the knowledge of H.R.C. members of interesting features of railways and railway working.

1. On the ends of L.N.E.R. coaches there are plates bearing four sets of figures. What do these figures represent? 2. What causes a locomotive to "puff"? 3. What is the difference between "double-ended" and "single-ended" points? 4. Where was the first train ferry in the world operated? 5. What is the regulation colour of the facing side of semaphore signal arms? 6. Where is the steepest gradient over which a down East Coast express operates? 7. What is the object of painting detonators different colours? 8. Which railway possesses the longest stretch of straight track in England? Where is it, and how long is it? 9. One, two or three white or black stars are painted on tank wagons. What do these mean? 10. What is the greatest altitude reached on the L.N.E.R. system, and where is it? 11. What is the origin of the expression "Permanent Way"? 12. Why do the side lamps of a goods brake van show a white light forward in addition to a red rear light?

Three prizes will be awarded in this contest, in each section, Home and Overseas, consisting of Meccano products to the respective values of 21/–, 15/– and 10/6.

Answers to the above questions must be written on one side of the paper only; on the reverse side must be written the competitor's name, address and H.R.C. number.

Envelopes containing entries must be marked *"H.R.C. Questions Contest No. 9"* in the top left-hand corner and posted to reach Meccano Ltd., Binns Road, Liverpool 13, on or before 30th October. The Overseas closing date is 31st January, 1938.

SETS (Postage Extra)

1	Antigua Jubilee ...	4d.	
3	,, Coron. ...	1/-	
1	Bechuanal'nd Jub.	4d.	
3	,, ,, Cor.	1/-	
1	Ceylon Jubilee ...	2d.	
3	,, Coron. ...	1/-	
1	Cyprus Jubilee ...	3d.	
3	,, Coron. ...	1/-	
1	Gambia Jubilee ...	4d.	
3	,, Coron. ...	1/-	
20	Gold Coast	1/2	
2	,, ,, Jub.	8d.	
3	,, ,, Cor.	1/-	
1	,, ,, Cor. used	3d.	
1	Jamaica Jubilee ...	2d.	
3	,, Coron. ...	1/-	
1	Kenya Jubilee ...	3d.	
3	,, Coron. ...	1/-	
1	Malta Jubilee ...	2d.	
3	,, Coron. ...	1/-	
2	Nigeria Jubilee ...	7d.	
3	,, Coron. ...	1/-	
1	Newf'ndland Jub.	4d.	
3	,, ,, Cor.	1/-	
3	N. Rhodesia Cor.	1/-	
3	Nyasaland Cor. ...	1/-	
1	Seychelles 12c. Jub.	9d.	
3	,, Cor. ...	1/-	
1	Sierra Leone Jub.	3d.	
3	,, ,, Cor.	1/-	
2	Straits Jubilee ...	6d.	
3	,, Coron. ...	1/-	
1	Trinidad Jubilee ...	3d.	
3	,, Coron. ...	1/-	
1	Turks Is. Jubilee ...	3d.	
3	,, ,, Coron. ...	1/-	

J. RUSSELL.
23, SHANKLIN DRIVE, WESTCLIFF-ON-SEA.

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(Dept. M), 59, LEE ROAD, BLACKHEATH, S.E.3.

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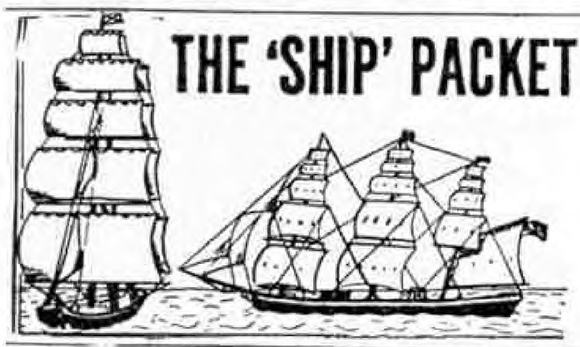
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173, LEA BRIDGE ROAD, LEYTON, E.10.



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3	Belgium "Coach"	1/3	3	N.Z. "Coronations"	1/6
3	China "Temple" ...	8d.	3	Nigeria ,,	9d.
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8 Different, 9d. 17 Different, 1/6. 24 Different, 2/4.
36 Different, 3/5. 42 Different, 4/3.

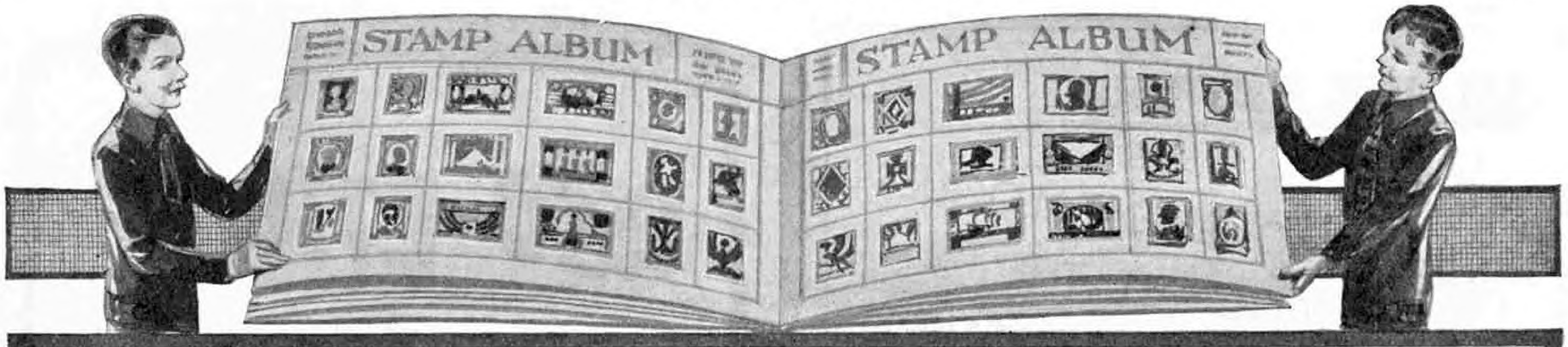
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For other Stamp Advertisements see pages 630 and XXII



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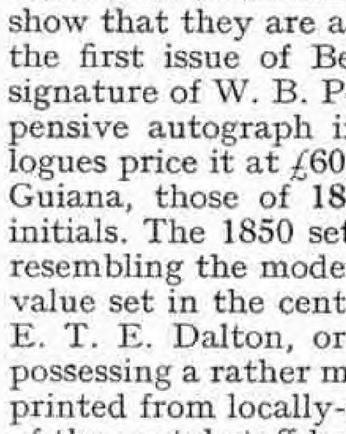
ALMOST every schoolboy collects autographs at some stage of his career. Few boys have been able to obtain the autographs of really celebrated or important people, but those who collect stamps can do the next best thing; that is they can build up a collection of stamps bearing autographs, including those of many famous men. In this way they can add a very novel section to an album of real autographs or to their stamp collections.



A collection of autograph stamps need not be costly, except for those who aspire to the possession of those early rarities, the U.S. "postmasters' stamps" issued in Baltimore, Greenwood and New Haven. These were provisionals with their values typeset or handstamped, and bearing the manuscript signatures of the respective postmasters, J. M. Buchanan, J. Bruce and E. Mitchell. The Jetersville "Postmasters" issue was in similar form but bore manuscript initials only.

There are several other stamps among very early issues that bear manuscript initials or full signatures to show that they are authentic. Notable among these are the first issue of Bermuda, which bore the facsimile signature of W. B. Perot. This is probably the most expensive autograph in our collection for current catalogues price it at £600! Two of the first issues of British Guiana, those of 1850 and of 1856, bore manuscript initials. The 1850 set consisted of a typeset impression resembling the modern circular cancellation stamp, but having the value set in the centre, and bearing the initials of the postmaster, E. T. E. Dalton, or one of his clerks. The 1856 issue, although possessing a rather more elaborate design, was also printed from locally-set type and initialled by one of the postal staff before issue. Colombia also provides a range of examples of stamps initialled or signed in manuscript by local postmasters.

There have been several instances in which a surcharge, accompanied by a postmaster's initials, has been applied to a limited number of stamps required for a special purpose. The most recent of these, and perhaps the most famous, was the April 1919 issue of Newfoundland, inscribed "Aerial Atlantic Mail. J.A.R." This provisional stamp was made by the postmaster, J. A. Robinson, for use on a small quantity of mail that was intended to be carried on the Morgan-Raynham trans-Atlantic flight. The flight did not take place and the mail was later carried to Europe by sea. Labuan, Venezuela and Pietersburg (Transvaal) also can provide examples of this type, the last-named actually being a war issue made by the Boers. It was in use in Pietersburg for six or seven weeks prior to the city's capture by British troops in April 1901.



Among other famous autographed stamps are certain of the early telegraph stamps of Great Britain, notably those of the British and Irish Magnetic Telegraph Company and other similar companies. These bore facsimile signatures of the Secretaries or Directors of the respective companies.



A few of the stamps with which we have been concerned up to this point are moderately priced, but the majority must be considered as out of the range of the average boy collector and it is to modern commemorative issues that he must turn for stamps to provide the basis of his collection of autographs.



At different times Norway has commemorated three of her leading dramatists by special stamp issues. The first of these was the set produced in 1928 to mark the centenary of the birth of Henrik Ibsen, the famous dramatist. As our illustration shows, the stamp bears Ibsen's portrait and a facsimile of his signature.

Björnstjerne Björnson, whose portrait and signature appear upon a series issued by Norway in December 1932, was contemporary with Ibsen. He was the author of Norway's national hymn, her greatest novelist and, next to Ibsen, her greatest dramatist. In his early writings he concentrated upon novels of peasant life, but later he turned to dramas of Norwegian history and social problems. He interested himself in politics, and in 1903 was awarded the Nobel Prize for Literature. Another Norwegian dramatist, Ludwig Holberg (1684/1754) was similarly honoured on the anniversary of his 250th birthday.

The French "Intellectuals Relief" series to which we referred in our "Stamp Gossip" last month, provides the autographs of Auguste Rodin, the great sculptor, and of Anatole France, one of the outstanding figures of French literature. Another writer to be included in the collection is Vazov, the Bulgarian poet, whose autograph is to be found on the 2 L. value of a series of six stamps issued by Bulgaria in 1920 to commemorate the 70th anniversary of his birth.

From Russia we take the autograph of Karl Marx, whose portrait and signature appear on an issue of 1933, commemorating the 50th anniversary of his death. Karl Marx was not a Russian, but his ideas are the basis of the modern Russian socialist state. He was buried in the Highgate Cemetery in London, and a picture of his grave forms the design of another stamp in this commemorative series.



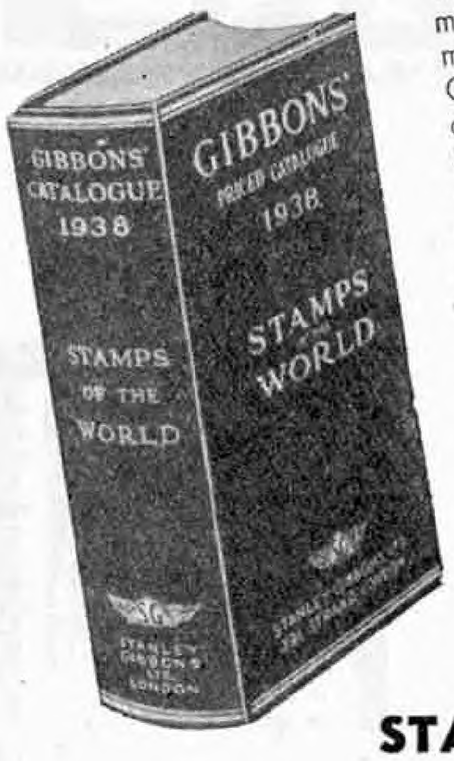
Another autograph from Russia is that of Maxim Gorki, the stamp being one of two issued in 1932 to mark the 40th anniversary of the publication of his most famous work.

Possibly the most interesting of all stamp autographs is that of St. Francis Xavier, shown on the 2 Reis value of the Portuguese India issue of December 1931 commemorating the St. Francis Xavier Exhibition at Goa. We reproduce the stamp here and it will be seen that the Francisco is perfectly legible. The hieroglyphics immediately preceding and succeeding the signature are rather puzzling, however, until it is explained that they are a contraction of his mother's surname, Xavier, which—(*Continued on page 631*)



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HELY. HUTCHINSON (M.1), Hurrock Wood, Kents Bank, Grange-over-Sands.

FREE 25 COMMEMORATIVES CAT. 4'9

A fine packet, mostly large pictorials commemorating famous men and events from Italy (Mussolini, Fascism and History); Greece (Tuberculosis); Sweden (Postal); J. Slavia (Independence); Russia (Revolution); Denmark (Hans Andersen), etc., etc.—Lastly a fine set of 6 Czecho-Slovakia Legionaires usually sold at 6d.

This marvellous packet free to every genuine applicant for my approvals. These books contain the finest variety at the very lowest possible prices, thus enabling you to buy **TWO** stamps instead of one.

A trial will convince you. Just send 2d. for postage, etc., and I will reply *by return*.

PHILIP COCKRILL, 13, MONTRELL ROAD, STREATHAM HILL, LONDON, S.W.2.

GRENADA PACKET FREE

LITTLE BUT GOOD is typical of this fine packet, which will be sent free to all applicants for my "Green Approval Books," sending 2d. for postage, etc. It contains the new George VI Grenada photogravure stamp, together with stamps from Ceylon (Plucking tea) and Holland (Jamboree) with several other scarce Colonials, and pictorials, from all parts of the world.

G. KINGSMILL (Dept. MM), NEW BARNET, HERTS.

100 "WORTH WHILE" 1/- Post Free
DIFFERENT BRITISH COLONIALS

JUBILEES, CORONATIONS, PICTORIALS, etc. I am **NOT TELLING YOU** what is in this packet. Take my word that it is **WONDERFUL VALUE.** If you are not completely satisfied, return, and I will refund your money and postage. **IS THIS FAIR? WITH "WORTH WHILE" APPROVAL SHEETS ONLY. "WORTH WHILE"** sheets for stamps **WORTH WHILE.**

JOS. H. GAZE, 21, Atwood Road, Didsbury, Manchester.

10	Different Coronation used	7d.
20	" " "	1/9
3	" Morocco Coronation mint	5d.
11	" " K.E.VIII mint	1/2

Postage 1½d. extra. Selections if desired.

J. R. MORRIS, 9, AUDLEY ROAD, FOLKESTONE, KENT.

CLOSING DOWN

The British Post Offices in French Morocco (Morocco Agencies) are closing down. To enable you to get the final issue we are presenting FREE one of the new King George VI Set, together with a special SET of FOUR French Morocco (Sultan's Palace, Tangier and Agadir Bay), a host of other stamps, with Pictorials, New Issues and other interesting specimens. A total of 109 ALL DIFFERENT, entirely FREE to Approval Applicants only. Please send 2d. for Postage. Abroad 6d.

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Given free to all genuine applicants for approvals enclosing 2d. for postage.

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For other Stamp Advertisements see pages 628 and XXII

Stamp Collecting—(*Continued from page 629*)

he adopted as his own.

In the field of science we have the autograph of Luigi Galvani, one of the pioneers of electricity, whose signature appeared on an Italian issue of 1934 issued in connection with the first international congress of electro-radiobiology. Galvani was professor of anatomy at the University of Bologna. He died in 1796, and the "galvanometer," an instrument that measures electric current, is named after him.

Our collection provides one royal autograph, that of Queen Elizabeth of Roumania, who wrote under the pen-name Carmen Sylva. The Queen spent a considerable amount of time endeavouring to improve the lot of the Roumanian peasantry, and most of her poems and stories deal with their lives and folk lore. Her autograph appears on four Roumanian Charity stamps issued in 1906.

Statesmen are represented in our collection by President Masaryk of Czechoslovakia. This veteran of European politics, who died in the early part of last month, has been variously featured on his country's stamps since 1918, when his name was overprinted on the country's first set. On 1st March, 1935, his 85th birthday, two special portraits accompanied by his autograph were used for a short set of commemorative stamps. We reproduce the 50 h. value from this series.

A careful search through an up-to-date stamp catalogue will reveal a number of other autographed stamps for our collection. No doubt others will appear, and in time a fascinating collection of notable autographs will be the reward of the collector who takes this subject in hand.

(*Continued from second column*)

general collector. This catalogue covers varieties of shade, watermark and perforation only when these are of importance. It lists 63,927 separate varieties of postage stamps, accompanied by more than 7,100 illustrations, and the text includes useful currency and geographical notes on the countries concerned. The number of new stamps added since the last edition is 1,772, and of these European countries have been responsible for 550, Africa 395, America 378, Asia 289, West Indies 96 and Oceania 64. The total number of stamps issued to date, as included in this catalogue, is 63,927. Europe heads the list with 20,277, Africa coming next with 14,052, followed by Asia with 11,569, America 11,200, West Indies 3,690 and Oceania 3,139.

Commemorative Stamp Sales

If proof were needed of the extent to which stamp collectors' purchases swell the sales of commemorative stamp issues, it is provided by the experience of New Guinea with the Papuan issue of King George VI Coronation stamps.

The total sales of this issue have exceeded £40,000, or more than three times the total post office receipts in any previous year! The Government have made a profit of nearly £30,000 on the issue.

This experience with an issue of a small country is exceptional. The occasion was one of world-wide importance and this issue, in common with all the British Coronation issues, was supported by a greater volume of publicity than any stamp issue has ever previously enjoyed. Even allowing for these factors, the figures are amazing, however.

Stamp Gossip
and Notes on New Issues

The 1938 Catalogues

Stamp catalogue sales have increased by 75 per cent. in recent years, for every collector realises he must have a catalogue if he is to keep abreast of his hobby's affairs.



The British catalogues cater for everyone's tastes. The "Big" Gibbons—or to give it its full title, *"Stanley Gibbons' Priced Catalogue of the Postage Stamps of the World"*—published by Stanley Gibbons Ltd., 391 Strand, London, W.C.2, price 16/– net, covers everything that any collector can wish to know about his stamps, as can be gauged from the fact that the 1938 edition contains 1,868 pages of stamp lists, and just under 100 pages of notes and price lists of accessories.

In all, 2,049 new stamps have been included in the catalogue. The most important of these are the new British Colonials issued to celebrate the Coronation in May last. There are more than 200 of these. Next in importance come the issues of Aden and Burma, these countries making their first appearance in the catalogue following their separation from India's administration. Other newcomers are the Italian issues for Abyssinia, and the French Indo-China issues for Annam and Cambodia.



The stamp "famine" mentioned by the publishers in the 1937 catalogue is still acute as regard many issues. World prices thus continue to move in an upward direction, and a feature of the new catalogue is a total of no less than 25,181 price alterations.

Stanley Gibbons also publish the *"Simplified Stamp Catalogue,"* price 5/–. This catalogue first appeared in 1934 and so great has been its success that the present is the sixth edition. The secret of its popularity is that it caters for the average collector, who does not interest himself in varieties of shade, perforation, watermark, and other points that are so important a feature of the "Big" Gibbons Catalogue. In spite of its simple basis the new edition contains 1,085 pages, and lists and prices 56,822 stamps, with 7,301 full size illustrations.



The *"Standard Catalogue of Postage Stamps,"* published by Messrs. Whitfield King and Company of Ipswich at 5/–, also meets the needs of the beginner and

(*Continued in previous column*)

Grenada King George VI Issue

The most interesting new stamp this month undoubtedly is the Grenada ¼d. stamp, illustrated here. It is the first ordinary Colonial stamp of the new reign. The design is of distinctly modern style, and it is not surprising that it has created controversy in stamp circles. Nevertheless we think most of our readers will agree that it is pleasing and attractive.

In reporting the new design, *"Gibbons' Stamp Monthly"* comments that it has heard that it is identical with the design provisionally approved for the first issue of Edwardian stamps in all the British colonies. Apparently the only difference is that the portrait of King George VI has been substituted for that of King Edward VIII.

* * * *

We reproduce this month the design of Egypt's new King Farouk stamps to which we referred in our August "Stamp Gossip" notes.

* * *

Afghanistan has issued a commemorative stamp, reproduced here, to celebrate the 4th anniversary of the Coronation of Mohamed Zahir Shah.

New Australian Stamps

We are indebted to E. G. Page and Co. of Sydney, N.S.W., our Australian agents, for copies of the new Australian 3d. stamp bearing King George VI portrait. The portrait is similar to that on the recent 2d. stamp, but its oval framing and accompaniment of wattle blossoms have contrived to make the design generally more pleasing than its predecessor.

We understand that this new stamp is to be followed by 6d. and 1/– values bearing Kookaburra and Lyre Bird designs respectively. The Kookaburra design will be a new one, showing the bird perched on a tree-stump with its head thrown back in the action of uttering its famous laughing call.



Later in the year ½d. and 1½d. stamps will appear. The former will show a Koala, while the 1½d. will bear a portrait of the King.

Also there is to be a series commemorating the 150th anniversary of the founding of New South Wales in 1787.

We thank Stanley Gibbons Ltd. for their courtesy in loaning the stamps from which the illustrations for our stamp pages have been made.

The Raining Tree of South Africa

One of the most remarkable trees in the world grows in Rhodesia. Even when the weather is perfectly fine, there is a haze of moisture in the air beneath the branches, and at times fine rain falls from them, forming puddles of water on the dry ground below.

This tree was noticed by Livingstone, who was greatly puzzled by it. To-day we know the explanation. Hundreds of thousands of tiny flying beetles feed on it. They have the curious power of taking in water from the air, where it is always present in the form of vapour, even in the hottest countries, and allow it to ooze out of their bodies, so that it runs down the bark and falls from the leaves in tiny drops.

The raining tree can be easily recognised by the smooth grey bark of its tall trunk, and its dark green leaves. Its name is "Cleta-Musi." This is a native word referring to the pungent smell of the wood when it is burned.

A "raining" tree that grows in South America was referred to in the "Of General Interest" pages of the *"M.M."* for August 1935. It is known as the Peruvian rain tree, and the "rain" is said to be caused by swarms of locust that descend on the tree, and suck the sap from the leaves and young shoots.

A Stirring Book

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C. E. KEY, F.R.G.S. Illus. 7/6 net

"The thirst for exploration which we all experience at times will either be intensified or temporarily assuaged by this absorbing book. In these packed chapters we can search the Amazon with Col. Fawcett, travel with Philby in Arabia, accompany Rosita Forbes into the deserts, keep step with Peary, Amundsen and Scott, fly over Everest or to the Pole with Byrd—all this without so much as suffering from a single blister."—*Daily Telegraph.*

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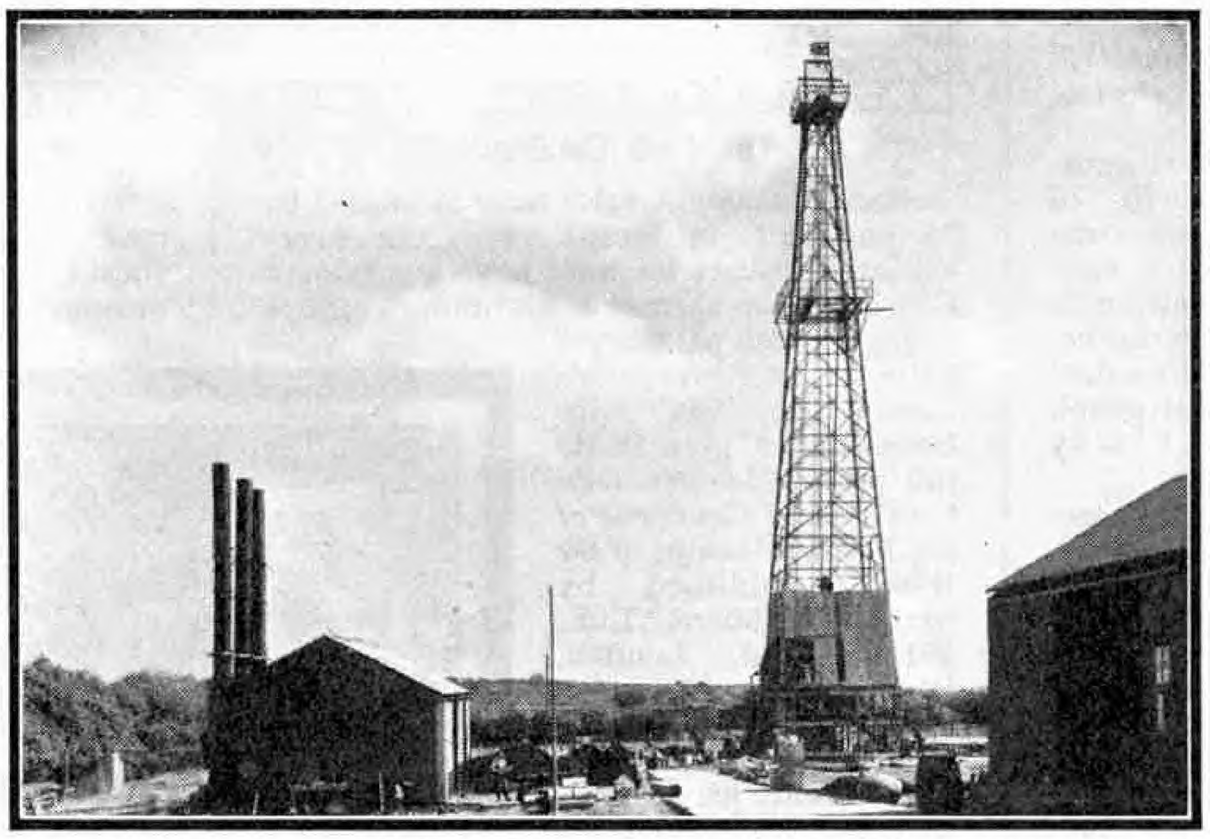
By RONALD W. G. BRYANT

The Keith and Portessie line, now dismantled, was built by the former Highland Railway in 1884, to serve the then rapidly developing fishing ports along the Moray Firth Coast. Fish traffic for the south could be taken via Keith and Elgin to Forres, and thence over the main Highland line to Perth. Yet the prospects were slight from the start, since at the same time the Great North of Scotland Railway built a line along the coast from Portsoy to Elgin. This not only had much easier grades, but also formed part of an alternative express route for G.N.S.R. trains between Aberdeen and Elgin, so that a much better train service could be provided.

The Highland branch had to cross a bleak moorland, at a summit level of 679 ft. Apart from the very heavy gradients, which made working difficult, it was liable to be snowed up in winter, and its intermediate stations could count on little traffic. During the War, the rails were taken up, and used to make the sidings laid down at Invergordon to cope with the great volume of special Fleet traffic. The company did not consider it worth while to resume the service afterwards, but local agitation succeeded in getting the Government to relay the metals. By this time the grouping had taken place, however, and the newly constituted L.M.S. did not see its way to start a train service. The chairs used in relaying were of Midland vintage, and thus travelled a long distance from their home country. The rails have now been lifted for the second and final time.

There are many bridges and heavy earthworks on the line, and at one point there is a handsome stone viaduct. At Portessie junction is made with the ex-Great North of Scotland coast line, now part of the L.N.E.R., and the Highland Railway turntable is still used on occasion. The exchange sidings form a useful storage annexe, since the L.N.E.R. goods yard at Buckie is liable to be congested, particularly in summer, when the drifter fleet is hungry for coal.

Before the War, the service consisted of four trains daily in each direction, passenger and mixed, worked by 4–4–0 tank engines originally built by Dubs and Co. of Glasgow for a railway in Uruguay. These were known to the staff as "Yankees." People in the district still talk of the manner in which these made their way up the stiff inclines.



The well at Hellingley, Sussex, where efforts are being made to find oil. An article on the well will appear in next month's "M.M." Photograph by courtesy of the Anglo-American Oil Co. Ltd.

Through the Kiel Canal

By RODNEY WATSON

Probably few people regard a canal as a holiday setting, yet the passage through the 61 miles of the Kiel Canal is full of novelty and charm as well as interest. This Canal connects the North Sea with the Baltic, and its construction cost £19,000,000.

After 36 hours spent in ploughing the waves of the North Sea, with glimpses of the Dutch coast and of Heligoland as the only relief, the giant locks of Brunsbuttel, the entrance to the Canal, loom phantom-like in the greyness of the morning mist. Stark and sombre, with flat-roofed stone buildings in the background, the massive pillars of the lock promise a harbour's calm. The ship's siren recalls the sleeping town to activity and crew and shore officials then work in unison with feverish energy. Meanwhile the tourist's attention is attracted by the ever-increasing array of enterprising merchants filling their large nets with Eau-de-Cologne, tobacco and cigarettes and holding them up on long, thin poles for inspection.

On entering the Canal the surrounding country is seen to be flat. Seven picturesque, high-level bridges span the watercourse. Trains roar overhead as we pass under some of these, and pedestrians thronging the footways call out greetings in broken English. A sharp bend brings a patch of woodland into view, with a sleepy hamlet nestling at the water's edge. There the channel is so narrow that two ships cannot pass, and one can easily read the name of the hamlet's unpretentious main street.

High embankments and a modern power-station herald the approach to a small town supplying electrical equipment for the Canal. A sudden widening of the course reveals a Greek liner alongside a French cargo boat, a German motor-launch just behind a Polish tramp-ship, tugs, and dredgers bringing up the rear. Finally we reach Kiel, and our trip is ended.

Speed Record Pictures for "M.M." Readers

Sir Malcolm Campbell's successful attempt on the water speed record, described on page 585 of this issue, has been made the subject of the first attempt to provide animated news pictures in pocket form. A film was taken of "*Bluebird*" tearing across Lake Maggiore, and the best "stills" from this film have been incorporated in an ingenious little book, or "flicker," that has been printed for C. C. Wakefield and Co. Ltd. When its pages are flicked over rapidly they provide a short moving picture showing Sir Malcolm Campbell's boat travelling at 129 m.p.h.

A number of copies of the booklet have been reserved for readers, and will be sent free to those who write at once to C. C. Wakefield and Co. Ltd., Cheapside, London, mentioning the "*M.M.*"

Oilers that Cannot Leak

Every reader of the "*M.M.*" knows how irritating it is to have an oilcan that leaks. The "Valvespout" oilcans made by our advertisers, Parker-Hale Ltd., are free from this defect, for each has a spout that contains a leak-proof valve. The valve is closed by half a turn of the spout, and only half a turn in the opposite direction is required to lift it from its seating in readiness for use. The "Valvespout," as this device is called, is made of solid brass and has no springs or soft washers in it to get out of order or detachable caps to get lost.

The range of oilers fitted with this device includes round, oblong and conical metal cans, with different lengths of spout to suit various purposes. Celluloid oilers also are included. These have the advantage that the amount of oil in them can be seen at a glance.

Competition Corner

HIDDEN ADVERTISEMENTS

The advertisement competitions that we have featured from time to time on this page have always proved extraordinarily popular, and we know that very many of our readers will welcome another of this type. In this month's contest readers therefore are asked to identify advertisements and advertised articles from clues given in the panel in the centre column at the foot of the page. Each clue is a simple direct statement based on a fact given somewhere in the advertising pages of this month's "*M.M.*" In some cases, but not all, the actual fact as stated in the advertisement is given in the clue.

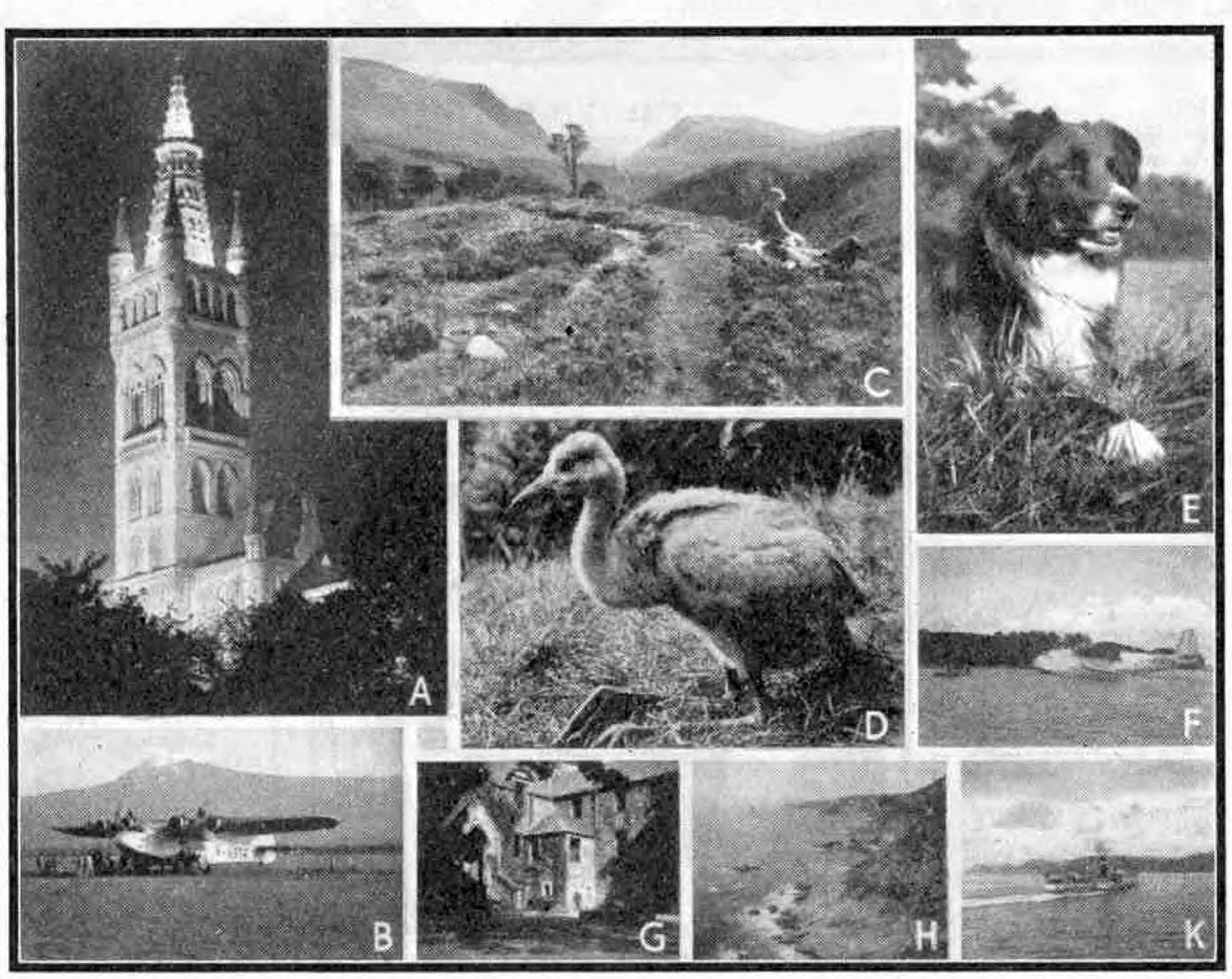
To make the idea clear, let us take clue No. 1: "This firm has only one address." Search will show this clue to refer to Hamley Bros.' advertisement on page i. It is based on the statement "Our only address."

Prizes of Meccano Products, that is of any goods listed in the current Meccano and Hornby Train catalogue, to the value of 21/–, 15/–, 10/6 and 5/– will be awarded to the senders of the four most accurate solutions. In the event of a tie for any or all of these prizes, preference will be given to those showing the neatest or most novel presentation. In addition there will be a number of consolation prizes.

Readers who do not succeed in solving all of the clues should not hesitate to submit an incomplete entry, for some of the advertisements will prove difficult to find and the first basis of judging will be the actual number of correct solutions.

Entries to this contest should be addressed "Hidden Advertisements, Meccano Magazine, Binns Road, Liverpool 13," and must be sent to arrive not later than 30th October.

A separate set of prizes, including several consolation prizes, will be reserved for entries in the special Overseas section, open to readers living outside Gt. Britain, Northern Ireland, the Irish Free State and the Channel Islands. These prizes will be of the same value as those awarded in the Home Section. Overseas entries must arrive not later than 31st January, 1938.



A selection of prize-winning photographs from the 1937 Photographic Contests. A. "Floodlight" (G. Buchanan). B. "Wings Under Kilimanjaro" (D. H. Parry). C. "The Path to the Larig Ghru" (F. H. Culverhouse). D. "Egret" (R. P. Tonkin). E. "Dog Portrait" (K. Dyson). F. "Ocean Wings" (J. A. Bell). G. "Dean's Court, St. Andrew's" (W. McCorkindale). H. "No Title" (O. M. V. Argles). K. "Outward Bound" (A. McDonald).

October Drawing Contest

This month we recommence our series of drawing competitions that have proved so popular in past winters. For the benefit of new readers we must explain that in these contests no special subjects are set, the monthly prizes being offered simply for the best drawings or paintings submitted during the month. The entries may be of any size to suit the competitor's preference.

The entries each month will be divided into the usual two sections, A for readers aged 16 and over, B for those under 16; and prizes of Meccano Products to the value of 21/– and 10/6 will be awarded in each section.

There will be special sections for Overseas readers in which prizes to the same amounts as in the Home sections will be awarded.

Entries to the October competition must be addressed "October Drawing Contest, Meccano Magazine, Binns Road, Liverpool 13," and must arrive not later than 30th October. Overseas closing date 31st January, 1938.

Intending competitors are reminded that unsuccessful entries can be returned only if a suitable stamped addressed cover is sent with the entry. Overseas readers desiring the return of their entries may send loose postage stamps of their own country equivalent in value to the cost of return postage.

CLUES TO HIDDEN ADVERTISEMENTS

1. This firm has only one address.
2. Here there are scores to choose from.
3. A new world is here, to be opened up.
4. These ships will sail indoors.
5. These are stained correct colour.
6. Boys over 13 can build these.
7. This has a range of 150 feet.
8. This advertisement reminds one of an auctioneer.
9. Five of these have chromium plated fittings.
10. Here people come to life.
11. These offer a lasting source of fun.
12. This has over a thousand uses.
13. This reveals how to be a master of disguise.
14. Realistic, speedy and holds the road.
15. This is sold in pin stopper tubes.
16. This kit contains moulds, metal and paints.
17. Of this, someone said "Its fine!"
18. These are adjustable with a coin.
19. Three "U's" are the key to this.
20. This firm was founded in a seven and trades in another one.
21. This conjures visions of the Spanish Main.
22. There are no others just as good.
23. This advertiser uses stars for pictures.
24. This advertiser gives two instead of one.

COMPETITION RESULTS

HOME

August Photo Contest.—First Prizes: Section A, T. Brooks (Halifax); Section B, P. J. Gandon (Leicester). Second Prizes: Section A, A. Bishop (Bristol, 4); Section B, J. B. Minter (London, N.4). Consolation Prizes: P. F. Chapman (St. Leonards-on-Sea); J. H. Neville (Edgware); D. W. Preston (Manchester, 14).

August Crossword Puzzle.—1. P. D. Ede (Calne). 2. T. D. Tasker (Barnsley). 3. L. V. T. Medlin (Par). 4. D. H. Tomkinson (Wells Green). Consolation Prizes: A. F. Baillie (Strathaven); L. W. Chitty (West Wimbledon, S.W.20); B. Hardie (Bristol 9); E. Maude (Leeds); D. Morley Davies (Maesteg); A. Russell (Harrow).

OVERSEAS

May Photo Contest.—First Prizes: Section A, J. M. Demanuele (Valletta, Malta); Section B, J. Robinson (Sydney, N.S.W.). Second Prizes: Section A, G. Papa (Naples, Italy); Section B, C. R. Anderson (Timaru, N.Z.). Consolation Prizes: A. H. Coverdale (Calgary, Canada); P. Macdonald (Toronto, Canada); W. C. Hon (Singapore, S.S.); H. Reid (Trinidad, B.W.I.).

Coronation Coach Contest.—1. C. Brewer (Hamilton, Ontario). 2. J. A. Nelson (Mitcham, S. Australia). 3. R. H. F. Denniston (Wanganui, N.Z.). 4. N. G. Gibson (Hastings, N.Z.). Consolation Prizes: I. Grayling (Eltham, Australia); N. A. Burt (Nelson, N.Z.); D. Tolkowsky (Tel-Aviv, Palestine).

NOTICE TO INTENDING COMPETITORS:

Entrants to drawing and similar competitions are asked to note that unsuccessful entries can only be returned if a stamped addressed cover is sent with the entry.



RINGCRAFT

"You say that my client kicked you in the face?" said the solicitor for the defence in an assault case.

"That's right," said the plaintiff.

"How on earth could a short man like my client reach your face with his foot?" triumphantly asked the lawyer.

"Well," said the plaintiff, "he knocked me down first."

* * * *

The science master asked the class to tell him what they knew of nitrates.

"They are much cheaper than day rates, sir," said Harry Smith, whose father worked in a telegraph office.

* * * *

A picnic party had just sat down to their meal.

"Isn't this an ideal spot for a picnic?" a man said, as he gazed at the surrounding scenery.

"It must be," replied his nephew. "Ten thousand wasps can't possibly be wrong."

* * * *

Master: "What does quartz consist of?"

Pupil: "Pints."

* * * *

Mike was trying his luck at the Aunt Sally stall at the fair. Taking careful aim, he let fly, and smashed a beautiful clock. Grinning broadly he threw his second ball, knocking to fragments a painted vase. Scarcely able to control his excitement, he threw his third, breaking a biscuit barrel.

Then he exclaimed, triumphantly: "Now give me one of those clay pipes!"

* * * *

Mr. Spoofham: "If my speech is too long, I am sorry. My watch is out of order."

Voice from the back: "There's a calendar behind you, old boy!"

* * * *

A Cockney went into a small shop and asked for a pennyworth of cheese.

"We don't sell penn'orths," said the shopkeeper.

"Well, show us two penn'orth," said the customer.

The two pennyworth was produced for inspection, whereupon the Cockney whipped out a pocket-knife, cut it in two, put down his penny, and picking up one half of the cheese, said: "What's the matter with you is that you don't understand mathermatiks."

* * * *

Hotel Clerk (to guest from the country): "Of course, you'll want running water in your room?"

Guest: "Why? Do I look like a trout?"

* * * *

Mother (hearing crash from dining room): "Johnny, whatever are you doing?"

Johnny: "Nothing; it's done!"

* * * *

MORE EFFECTIVE!



"Aren't you afraid the birds will eat your seeds? You ought to put up a scarecrow."

"Oh, it's not worth it. There's always one of us in the garden."

THE CURE

Patient (rushing into consulting room): "Doctor, I'm having trouble with my breathing."

Doctor: "Don't worry; I'll soon stop that."

* * * *

Farmer (bursting into the village inn): "What do you think, Silas? The bones of a prehistoric man have been found on George White's farm."

Innkeeper: "Great Scott! I do hope poor George'll be able to clear himself at the inquest."

* * * *

Cinema box-office man: "Why aren't you in school?"

Johnny: "It's all right, sir. I've got measles."

* * * *

HARD LINES!



Two stuttering blacksmiths had finished heating a piece of iron, and one placed it on the anvil with a pair of tongs.

"H-h-h-h-hit it," he stuttered to his helper.

"Wh-wh-wh-wh-wh-where?" asked the other.

"Aw d-d-d-dash, we'll have to h-h-heat it again now."

* * * *

Two tramps were looking round for a place in which to sleep.

"What yer going to use as a pillow?" asked Willie.

"This bit of drain-pipe," said Tim.

"Drain-pipe?" echoed his companion. "Won't that be a bit 'ard?"

"'Course not," said Tim. "I'm going to stuff it with straw."

* * * *

Foreman: "You ain't one of them men as drops their tools and scoots as soon as knock-off blows, are you?"

Labourer: "Not me. Why, I often have to wait five minutes after I puts me tools away before the whistle goes."

* * * *

The small boy was making his first acquaintance with stewed figs, which he didn't like.

"Eat up your figs like a good boy," said his Mother.

"I don't like 'em," he replied. "They're just skins full of full stops."

* * * *

"And how do you find the razor, sir?" asked the barber.

"I didn't know I was being shaved," replied the customer.

"Very glad, I'm sure," said the barber, with a gratified smile.

"No; I thought I was being sandpapered.

* * * *

Kindly Shopkeeper: "Well, does my little man want to buy chocolates?"

Jimmy: "You bet I do, but I've got to buy soap!"

* * * *

"Ladies an' gents," exclaimed the street performer, "I will astonish you by eatin' coal, stones an' nails. I will also swallow a sword, after which I will come round with the hat, trustin' to get enough for a crust o' bread."

"Lumme!" said a voice. "Still 'ungry!"

* * * *

THIS MONTH'S HOWLER

"Noah's Ark was made of wood, but Joan of Arc was made of Orleans."

GOOD FISHING!

A visitor to a hospital for the mentally afflicted saw one of the inmates holding a rod and line over a bed of flowers. Thinking to humour him, the visitor said:

"Fishing?"

"Yes."

"Catch many?"

"You're the ninth this afternoon," said the fisherman.

* * * *

Voice (over telephone): "Police speaking. We've caught the man who stole your car."

Motorist: "Good! I'll be round in five minutes. Be sure not to let him go because I want him to tell me how he got it to start."

* * * *

Old Farmer (putting out his leg): "I want you to look at me cow, doctor. It's painful and I . . . ."

Doctor: "Oh, you mean your calf."

Farmer: "No, I don't. Whoever saw a calf seventy-five years old?"

* * * *

A policeman's ghost is said to be haunting an Essex tavern.

An inn-spectre!

* * * *

Sergeant: "Did you shave this morning, Jones?"

Private: "Yes, sergeant."

Sergeant: "Well, next time stand a bit closer to the razor."

* * * *

Tommy arrived home one day from school bearing signs of having been in a fight.

"Tommy!" said his mother, "tell me how you got that black eye."

"I was protecting a little boy," said Tommy, and immediately his mother's face softened.

"That's a good child," she said, approvingly. "And who was the little boy?"

"Me."

* * * *

"Is that hair tonic any good?"

"Well, I spilled some of it on my comb last week and now it's a brush."

* * * *

Bill: "I hear your brother is in hospital."

John: "Yes."

Bill: "What happened to him?"

John: "He bet me he could lean farthest out of the window—and he won!"

* * * *

Teacher: "Johnny, who was Anne Boleyn?"

Johnny: "Anne Boleyn was a flat iron."

Teacher: "What on earth do you mean?"

Johnny: "Well, it says here in the history book: 'Henry, having disposed of Catherine, pressed his suit with Anne Boleyn'."

* * * *

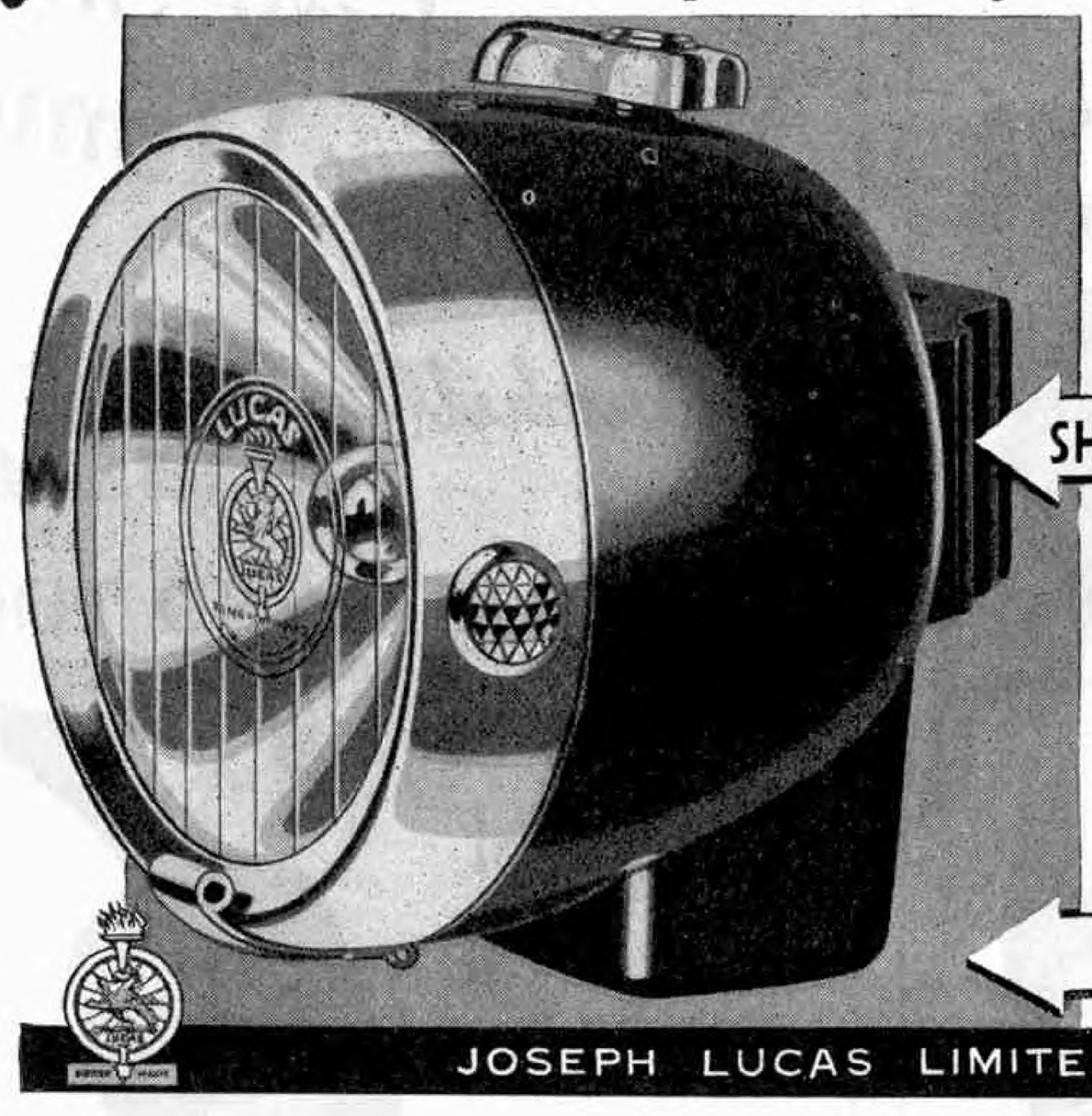
GIVING HIM AWAY!



Attendant (at fair ground). "Do you wish to consult Woosung Portung, the great Chinese mystic, madam?"

Woman: "Aye, laddie. Tell him his mither is here frae Scotland."

The Battery Lamp WITH ALL THE GOOD FEATURES



LUCAS No. 310RS

SHOCK ABSORBING RUBBER BRACKET

Patented Shock-Absorbing Rubber Bracket, combined with Battery Cushion—absorbs road shocks, eliminates rattling and creaking, preserves bulb and battery life, ensures firm battery contacts. The very finest Rubber obtainable (Air Ministry specification)—unaffected by extreme climates.

Large capacity Lucas "Leadership" Battery housed in special well. Large silver-plated reflector giving brilliant long-range beam. Dimming Switch **7/6**

Many other fine battery models—**2/6** to **18/6**. See them at your dealers, or write to Dept. X for particulars of complete range.

LARGE CAPACITY BATTERY

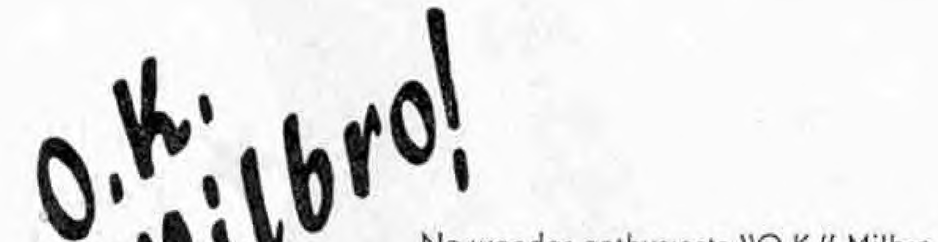
JOSEPH LUCAS LIMITED, BIRMINGHAM.

O.K. Milbro!

No wonder enthusiasts "O.K." Milbro when Milbro models are such marvels of realism and true-to-scale detail. Milbro engineers work to limits as close as .001 in. to ensure the life-like touches that give Milbro models such a fascinating appearance. Every detail is exact and up-to-date.

Once more Milbro present in their latest 108-page Catalogue, price 6d., the most marvellous range of true-to-scale models in existence! Milbro realism is a byword. Every detail is accurate and up-to-date. Send to-day for your copy of this wonder book of models—and judge for yourself.

WAYSIDE HALT, Price 3/9



Model SJO. A very useful building for the country portion of a model railway and a good example of Milbro realism. Complete with waiting shelter and miniature advertisements.

MILBRO *TRUE-TO-SCALE models for reliability*

MILLS BROS. (Model Engineers) LTD., Dept. F.S., St. Mary's Road, SHEFFIELD, 2

For 8/- Down

A HOME ATTRACTION THAT KEEPS THE FAMILY TOGETHER

A Riley 'Home' Billiard Table ends all problems of providing healthy recreation for the family. Grown ups and children will be GLAD to stay at home—when there's a Riley 'Home' Billiard Table there. You can buy a Riley 'Home' Billiard Table by easy monthly payments for as little as 8/– Down, Carriage Paid, and 7 days' Free Trial. Sizes and cash prices are

4′ 4″×2′ 4″ ...	£7	0	0
5′ 4″×2′ 10″ ...	£9	0	0
6′ 4″×3′ 4″ ...	£11	15	0
7′ 4″×3′ 10″ ...	£15	0	0
8′ 4″×4′ 4″ ...	£21	10	0

or in 20 monthly payments of 8/–, 10/3, 13/3, 17/– and 24/6.



Here is the Riley "Cabriole" model, Combine Table. Cash price, 6 ft. size, £34/10/– or easy terms.

RILEY "COMBINE" BILLIARD AND DINING TABLES give a final touch of perfection to the really charming home. A beautiful piece of furniture ready for either use in two minutes. Many attractive models, oak or mahogany, in sizes for any room. Cash prices from £22/10/0 upwards or 13 or 20 monthly instalments.

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32 Free Billiard Tables. Write for details and coloured Art List showing all models of Riley Billiard Tables.

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"HOLDING"

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Sold everywhere in pin-stopper tubes, complete with directions for use, 4½d., 6d., and 9d.

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The Double Strength ADHESIVE

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It—
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etc.

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LONDON, S.E.11

for Handbook and Name of nearest Stockist



I'm exchanging my old Hornby engine for a new one!

Boys! Here is a plan to secure a fine new Hornby Locomotive in exchange for your old one.

First of all, study carefully the latest Hornby Train Catalogue, and select from it the new up-to-date Hornby Locomotive you want. Then pack up your old Hornby Locomotive and send it to us addressed "Special Service Department," Meccano Ltd., Binns Rd., Liverpool 13. Your order for the new Locomotive and the necessary remittance should be enclosed. You can easily ascertain how much to send by deducting the part exchange allowance indicated in the list given below from the price of the new Locomotive, and adding 1/– for postage on the new model you purchase. It is important to note that the catalogue price of the new Hornby Locomotive you purchase **must not be less than double the Part Exchange allowance made for your old Locomotive.**

If you prefer to do so, you can effect the exchange through your dealer, who will be very pleased to give you any information you require.

Part Exchange allowances for Hornby Locomotives

CLOCKWORK MODELS		ELECTRIC MODELS	
M2930 Locomotive	1/–	EM16 or EM120 Locomotive ...	4/3
MO Locomotive...	1/4	No. 1 Electric Tank Locomotive, Permanent Magnet	7/6
M1/2 Locomotive	2/3	EM36 or EM320 Tank Locomotive	8/3
*George V Locomotive ...	3/3	LST M3/20 Tank Loco (20-volt)	8/3
*No. OO Locomotive	3/3	E06 or E020 Locomotive ...	9/6
M3 Tank Locomotive	3/9	LE 120 Locomotive	10/–
M3 Locomotive	4/3	LE1/20 Loco (Swiss Type) 20-volt	10/–
Zulu Locomotive	4/6	E16 or E120 Locomotive ...	10/–
No. O Locomotive	4/6	E16 or E120 Tank Locomotive	10/–
LEC 1 Locomotive (Swiss Type)	5/3	LST 1/20 Tank Locomotive (20-volt)	12/–
Zulu Tank Locomotive... ...	5/9	LST 2/20 Tank Locomotive ...	12/6
No. 1 Tank Locomotive ...	5/9	E3/20 Locomotive	12/6
No. 1 Locomotive	5/9	E3/20 Riviera Locomotive ...	12/6
No. 1 Special Locomotive ...	7/9	No. 2 Electric Tank Locomotive	12/6
No. 1 Special Tank Locomotive	7/9	EPM16 Special Tank Locomotive	13/9
No. 2 Locomotive	9/9	E26 Special Tank Locomotive ...	13/9
No. 2 Tank Locomotive ...	9/9	E120 Special Locomotive (automatic reverse)	13/9
No. 2 Special Tank Locomotive	9/9	E120 Special Tank Locomotive (automatic reverse)	13/9
Metropolitan C Locomotive ...	10/6	E36 Locomotive	15/–
No. 2 Special Locomotive ...	11/3	E36 Riviera "Blue" Locomotive	15/–
No. 3C Locomotive	11/3	E220 Special Tank Locomotive (automatic reverse)	15/–
No. 3C Riviera "Blue" Locomotive	11/3	LE2/20 Locomotive	15/–
		Metropolitan L.V. Locomotive	15/–
		E36 Metropolitan Locomotive...	15/–
		LE220 Locomotive (automatic reverse)	16/3
		E320 Locomotive (automatic reverse)	16/3
		E320 Riviera Locomotive (automatic reverse)	16/3
		E220 Special Locomotive (automatic reverse)	18/9
		Metropolitan H.V. Locomotive	18/9

*These models were identical.

HORNBY TRAINS

BRITISH AND GUARANTEED

Manufactured by

MECCANO LTD. — LIVERPOOL 13

ALL THESE FLYERS are easy to build..

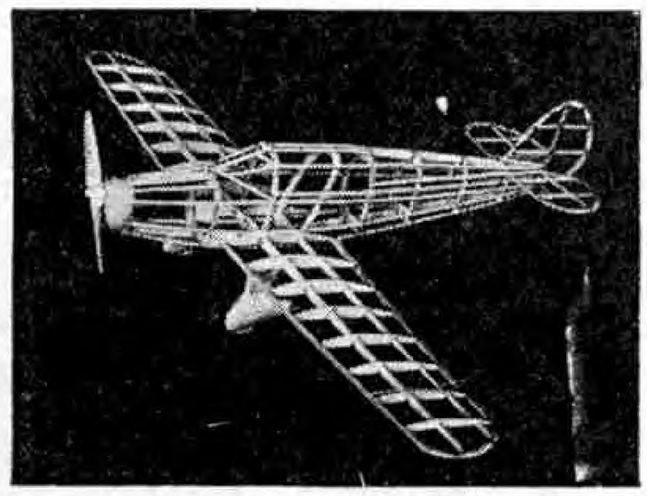


HESTON PHOENIX

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PUSS MOTH

Wing 16 in. Ideal beginner's kit—simple to build, exact replica of Mollinson's "Heart's Content," and fine flyer. Kit has everything needed, quick-drying cement, flying prop, etc., post free **2/6**

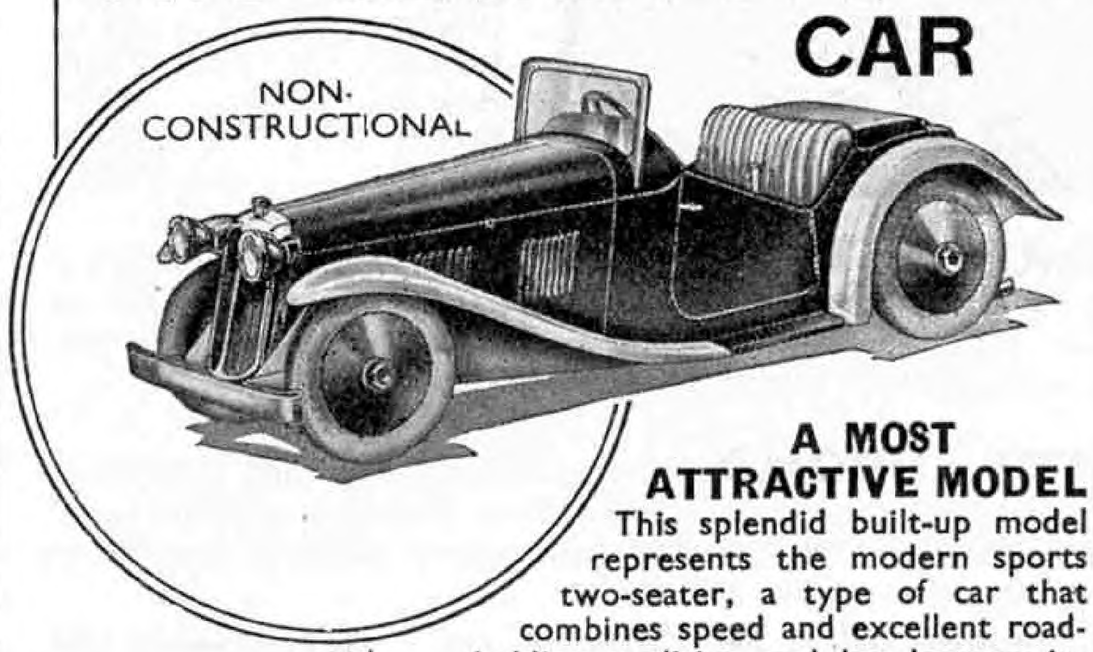
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M. SWEETEN LTD.

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A MOST ATTRACTIVE MODEL

This splendid built-up model represents the modern sports two-seater, a type of car that combines speed and excellent road-holding qualities, and has become increasingly popular during recent years. Speed is suggested by the sweeping lines of the bodywork and mudguards, together with the sloping radiator and wind-screen.

The model faithfully resembles its prototype in all important respects. It is complete in itself, no constructional or assembly work being required. It steers from the wheel. and is fitted with a strong clockwork motor that gives a long and steady run.

Overall dimensions: Length, 8½ in.; Width, 3¼ in.; Depth, 2⅞ in.

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Box 3
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5/-



Each set is complete with chemicals, apparatus, and Books of Experiments. These books are written by a Doctor of Science, and are fully illustrated.

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SPARES LIST. To get the most out of your Chemistry Hobby you need the extra apparatus shown on the Spares list which is sent FREE on request. With this extra equipment you can enlarge the range of your experiments and have a laboratory fitted out like the real thing.

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LOTT'S TUDOR BLOCKS. Tudor blocks have a charm entirely of their own, for with them any boy or girl can build delightful models of Old English half-timbered buildings with Tudor Doors, Windows, etc.

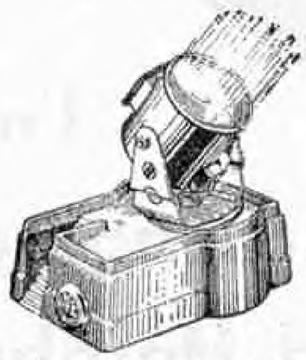
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REAL WORKING MODELS

SEARCHLIGHTS. 300 ft. beam (as illustrated), **3/6.** 450 ft. beam, **4/11.** Super Searchlight, tremendous range, **7/11.**

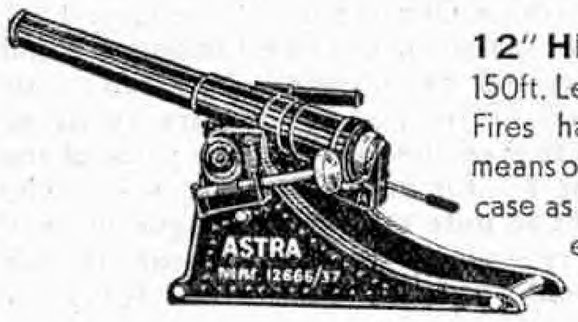


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Both these guns are amazingly powerful and accurate and give a very loud report. The operation is extremely simple and reliable.

Also model Traffic Signals, Harbours, Lighthouses, Aerodrome Floodlights, Aero Launching Decks with Indoor Flying Planes and other original models.

OBTAINABLE AT ALL GOOD STORES AND TOY SHOPS



12" HEAVY HOWITZER. Range 150ft. Length 10½ inches. Price **10/6.** Fires harmless rubber projectiles by means of ordinary caps loaded in a shell case as in a real gun. Smoke and flash emitted from the barrel.

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MECCANO LTD., BINNS ROAD, LIVERPOOL 13

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De H. "Leopard Moth." Wing Span 9½"

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Any one of the following types can be made from this kit—"Hart," "Hind," "Demon," "Audax" or "Osprey." **Price 3/-.** (Postage abroad 1/- extra.)

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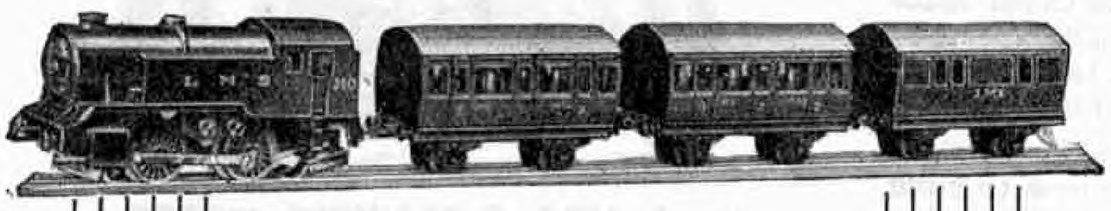
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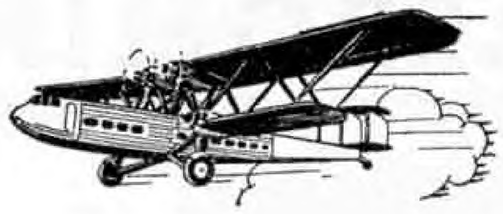
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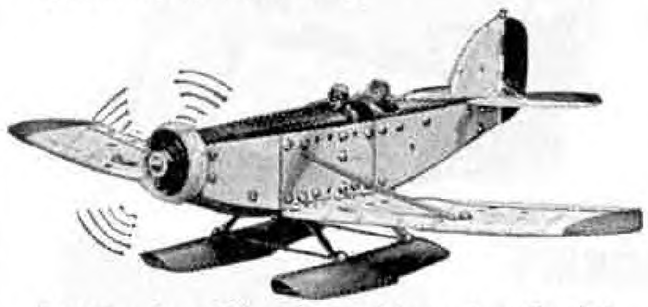
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This Motor fits into the fuselage of models made with No. 1, No. 2, No. 1 Special or No. 2 Special Aeroplane Outfits. It will rotate the propeller at high speed, thus adding to the realism of the model. Price 1/9

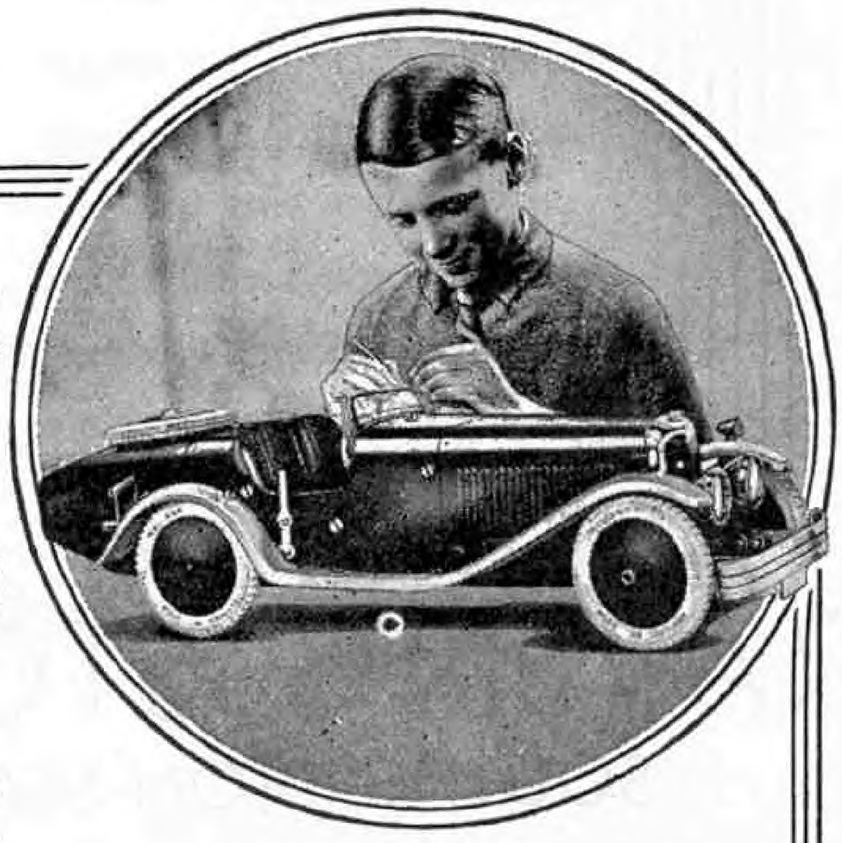
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No. 1 Motor Car Constructor Outfit. Price 8/6

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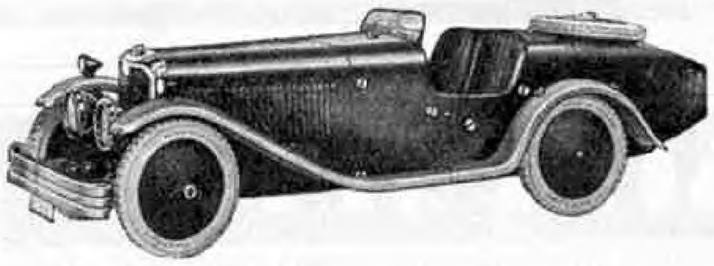
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With this Lighting Set the headlamps of Motor Car models built with the No. 2 Motor Car Outfits can be electrically lighted. Price 2/6

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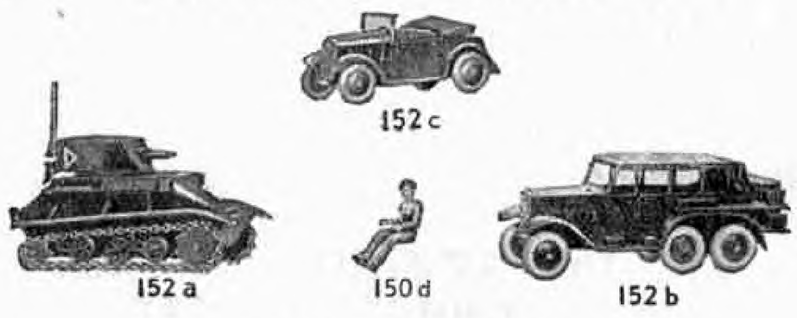


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No. 150a	Officer	each	**3d.**
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No. 150e	N.C.O.	,,	**3d.**

Price of complete set **1'6**

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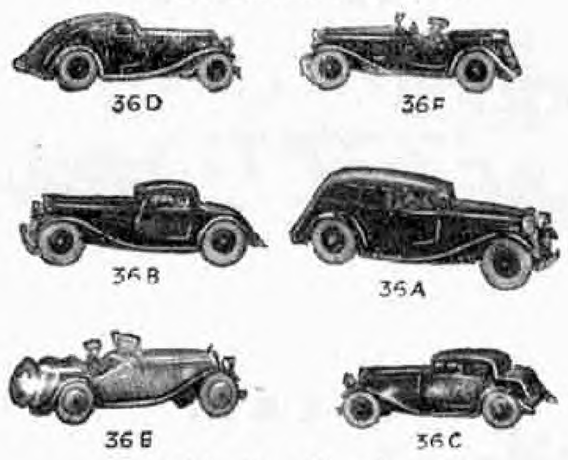


Dinky Toys No. 152

No. 152a	Light Tank (4½ tons, 25 h.p.)	each	**1'1**
No. 152b	Reconnaissance Car	,,	**1'-**
No. 152c	Austin Seven Car	,,	**4d.**
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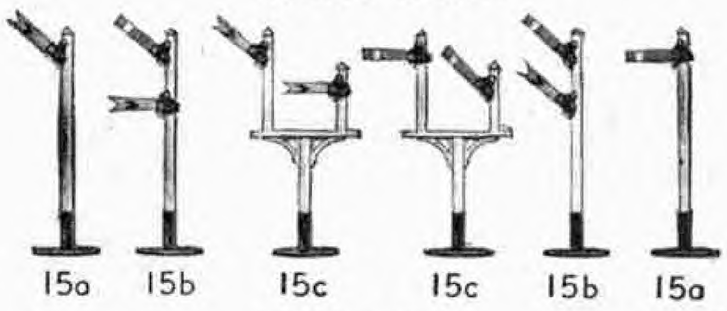


Dinky Toys No. 151

No. 151a	Medium Tank (12 tons, 90 h.p.)	each	**1'6**
No. 151b	Three-ton Transport Wagon	,,	**1'-**
No. 151c	Cooker Trailer with jack stand	each	**7d.**
No. 151d	Water Tank Trailer ...	,,	**5d.**
No. 150d	Driver	,,	**3d.**

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R.A.F. AEROPLANES





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Dinky Toys No. 60r

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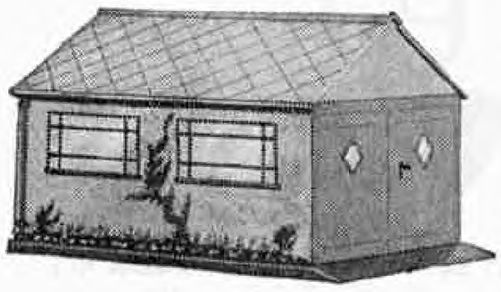


ROBOT TRAFFIC SIGNAL



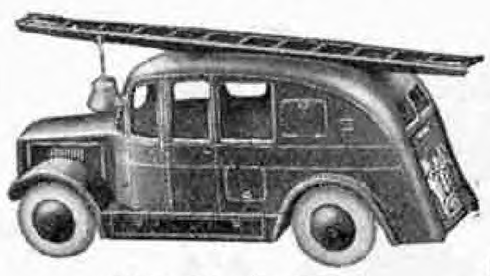
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Dinky Toys No. 45
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(Four face)
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Right-angle or back-to-back. Price **3d.** each

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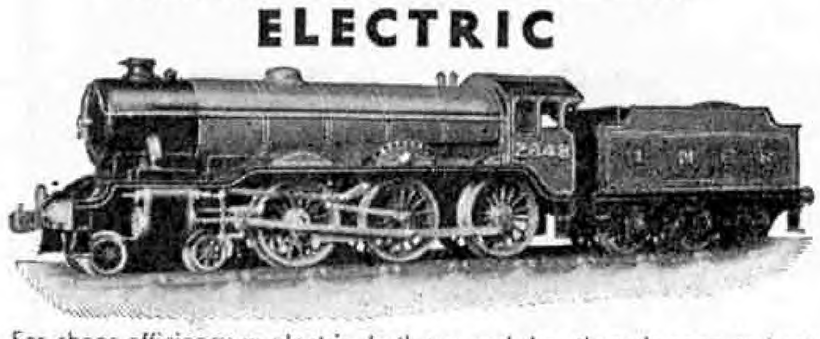
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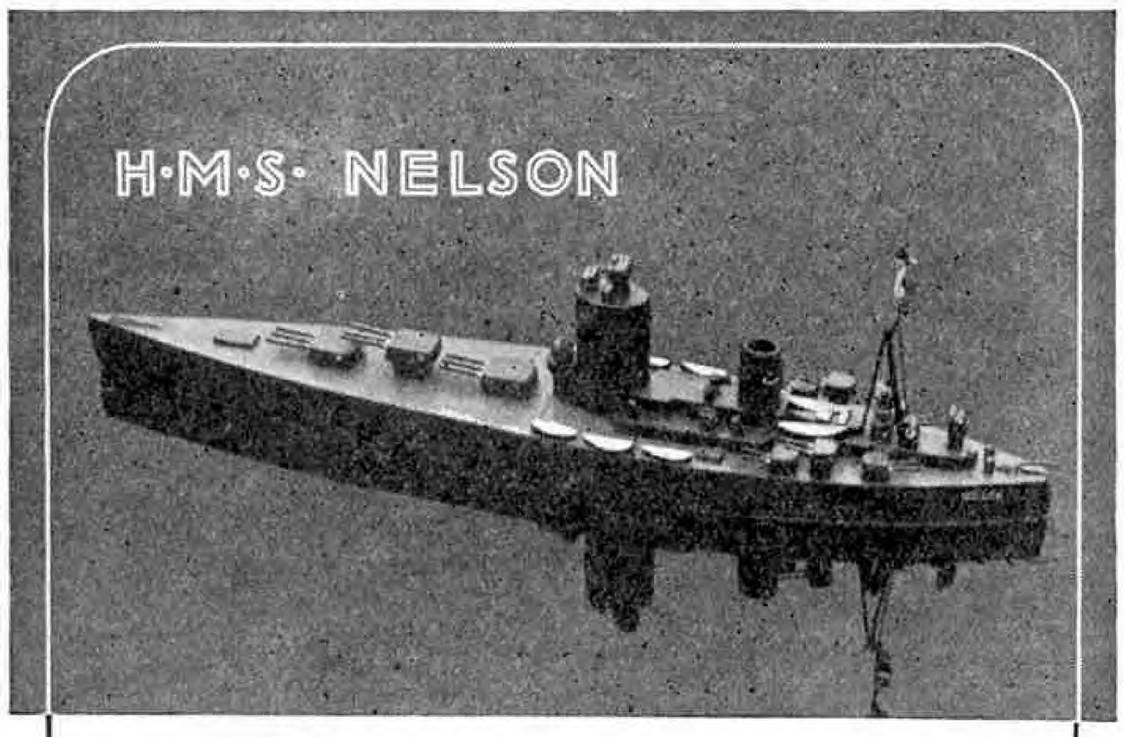
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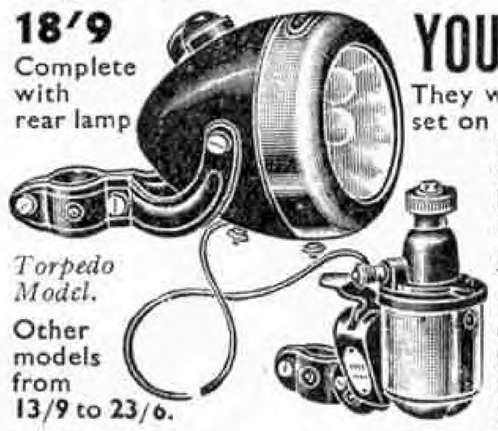


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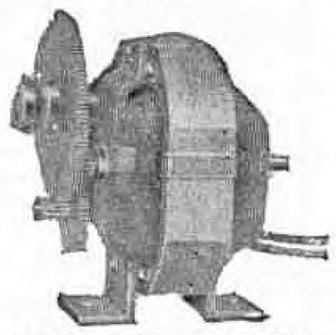
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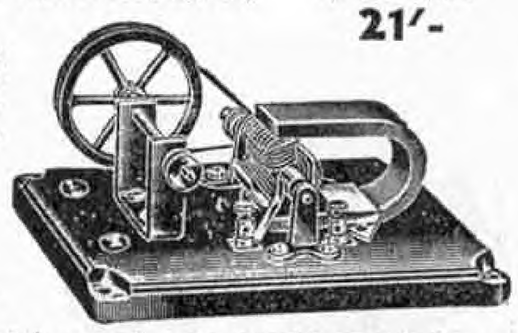
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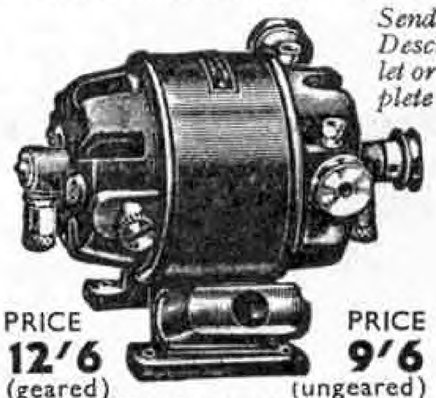


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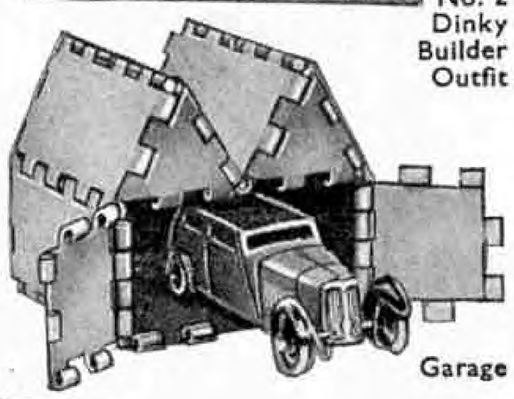
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No. 2 Dinky Builder Outfit



Garage

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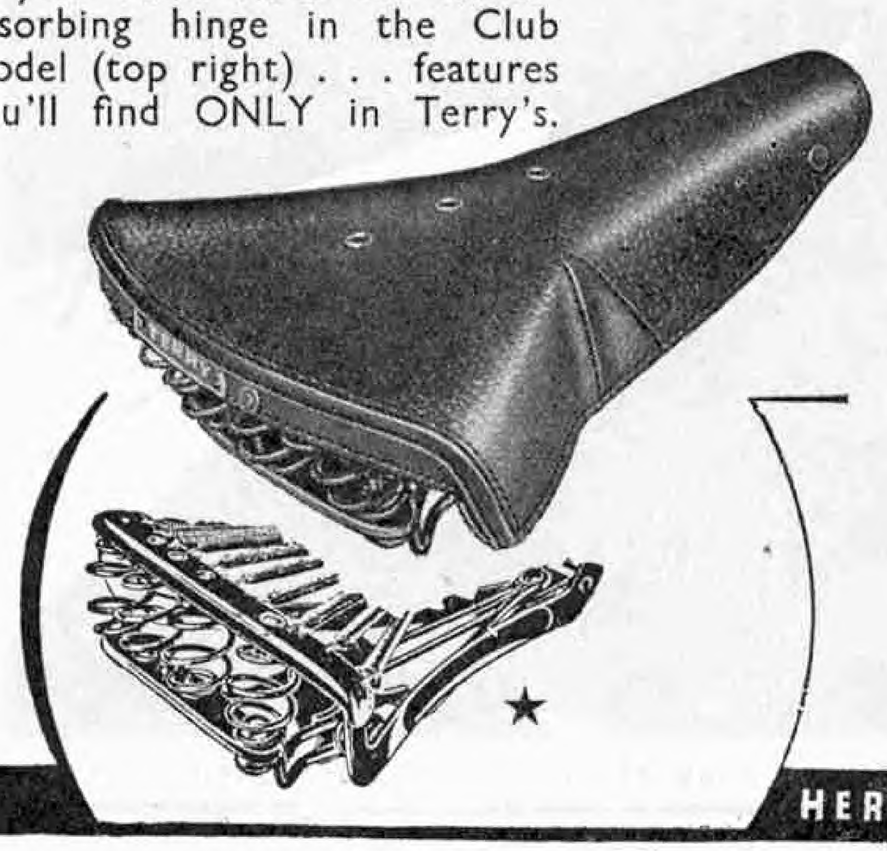
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Roadster Model, 1263, **13/6.** Club Model, 1265, **10/6.**

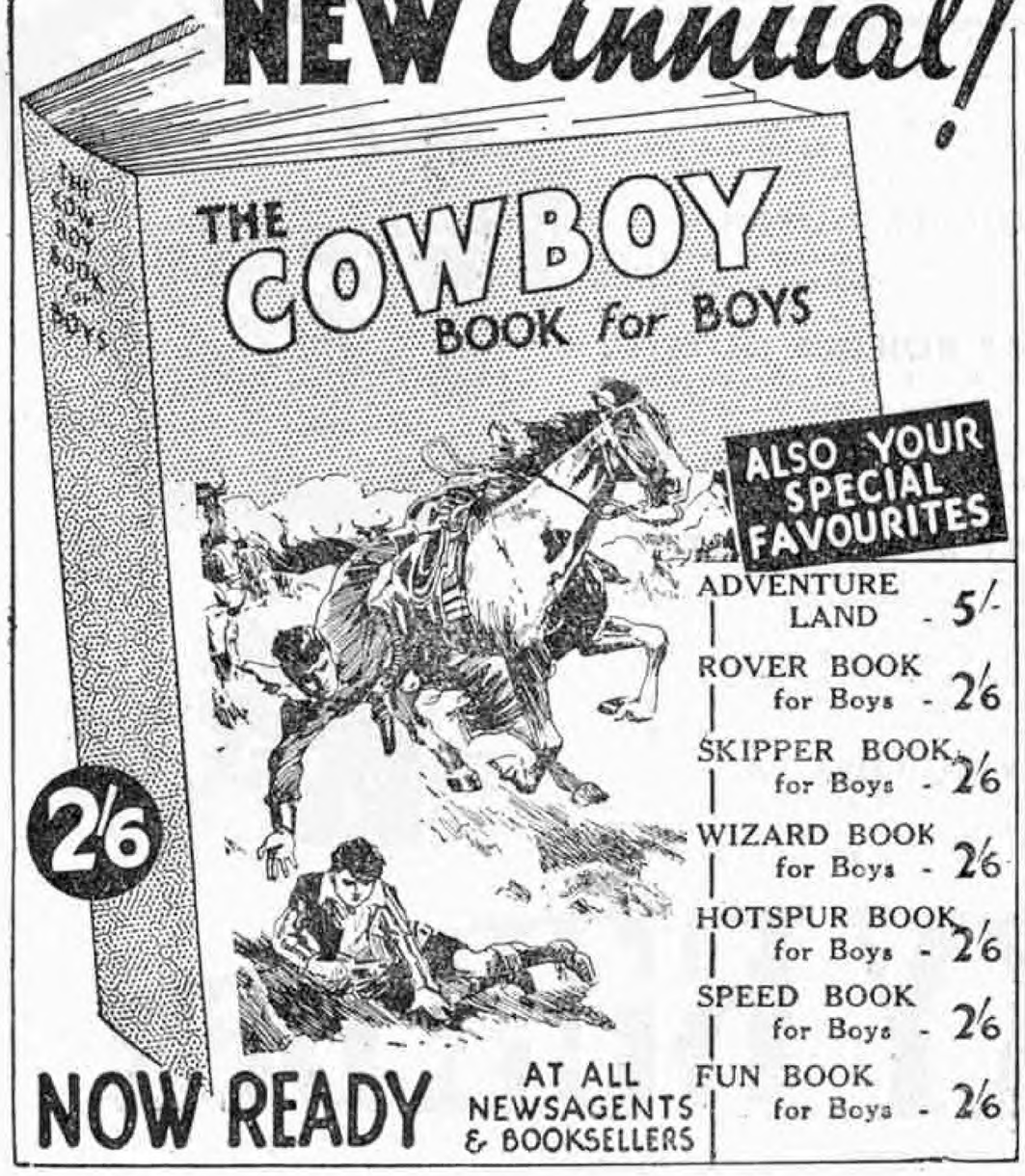
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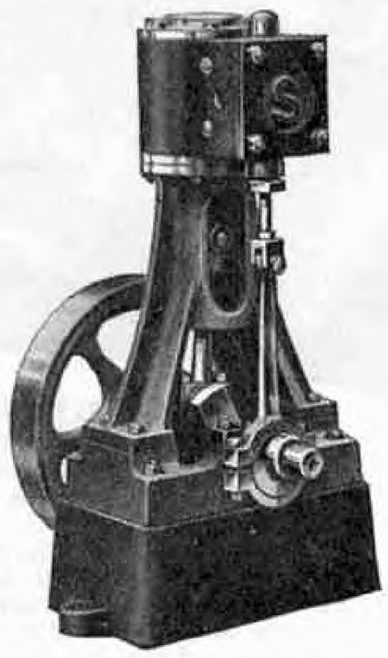
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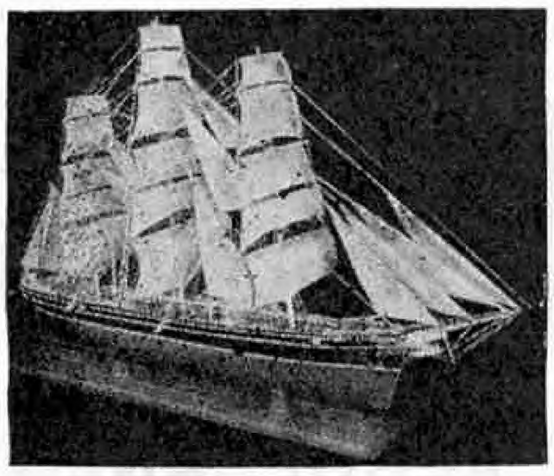
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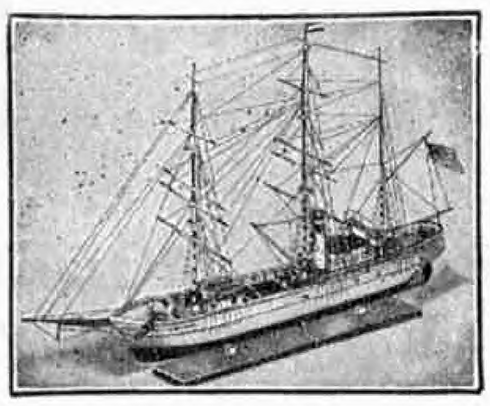
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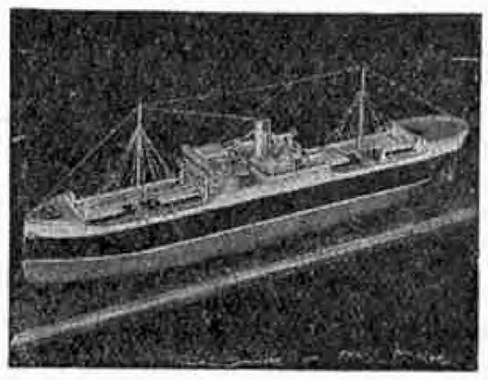
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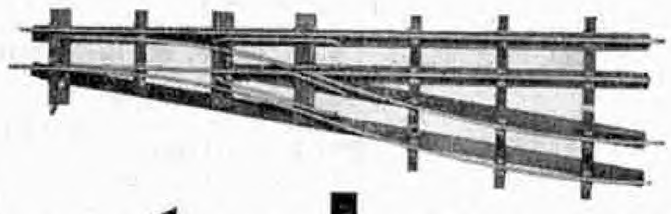
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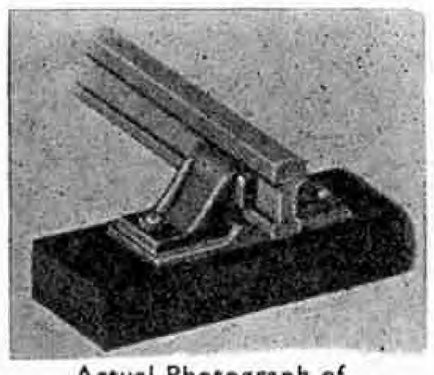
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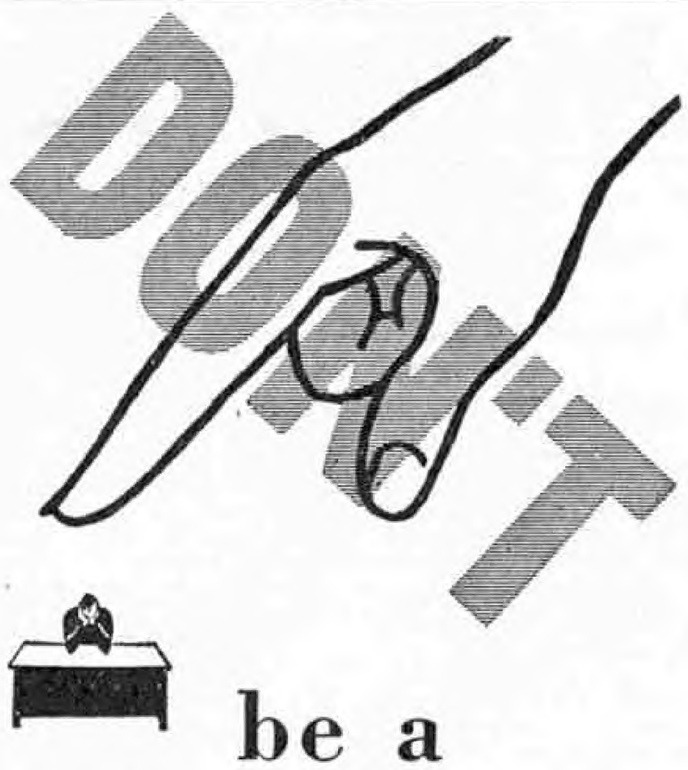
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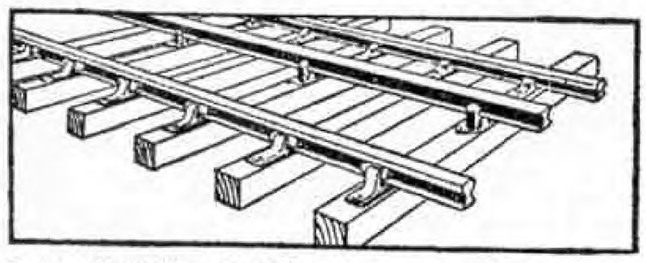
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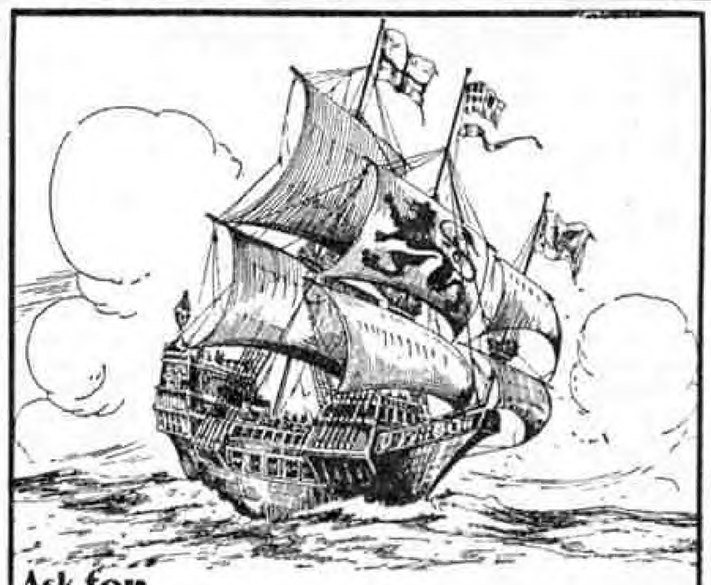
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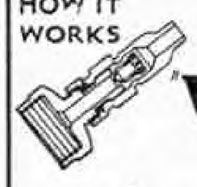
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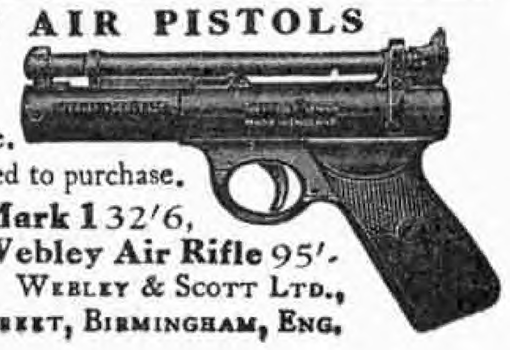
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M9 Complete Model Railway Set



M10 Complete Model Railway Set

M8 Complete Model Railway

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M10 Complete Model Railway

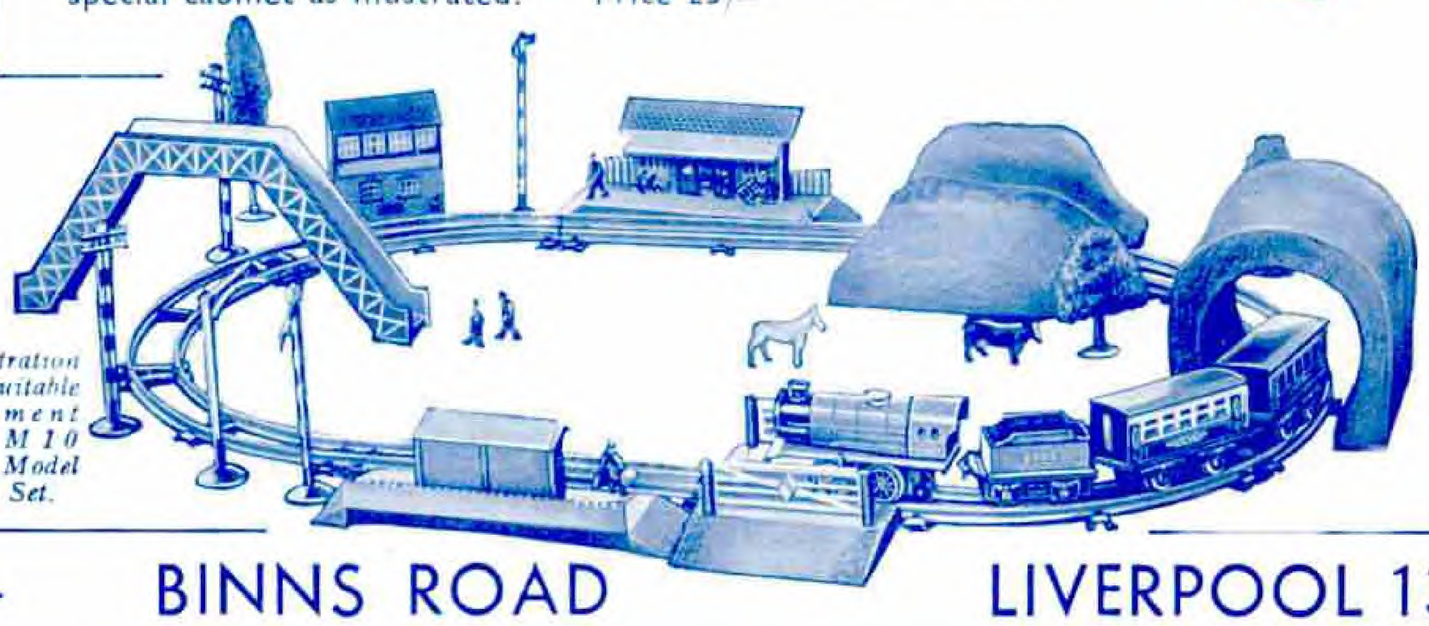
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M11 Complete Model Railway Set



This illustration shows a suitable arrangement of the M10 Complete Model Railway Set.

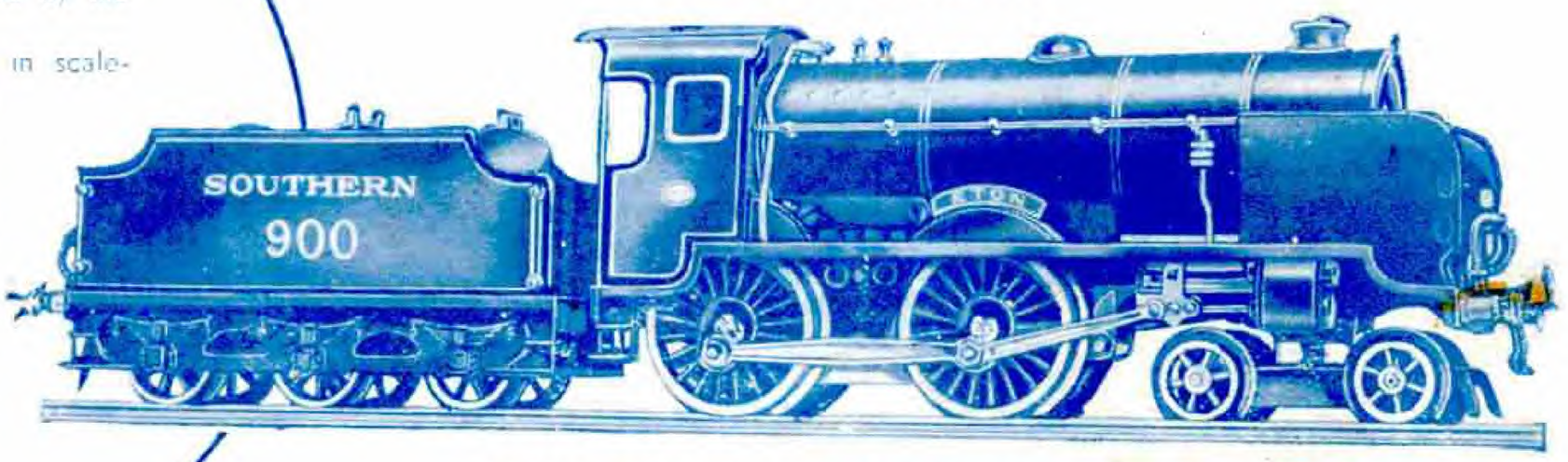
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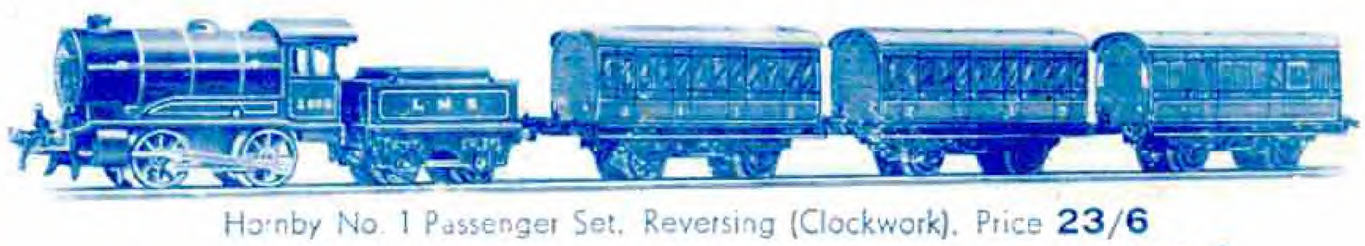
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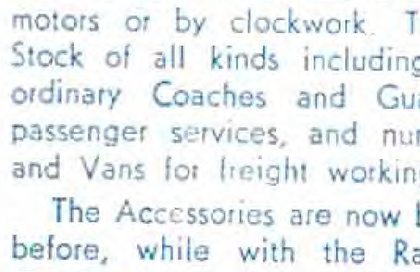
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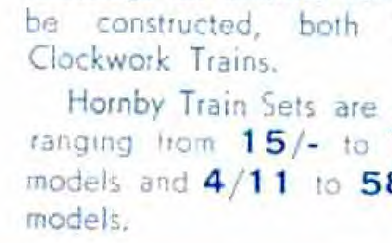
EM120 (20-volt) or EM16 (6-volt) ELECTRIC LOCOMOTIVE



EO20 (20-volt) ELECTRIC LOCOMOTIVE

E220 (20-volt) SPECIAL ELECTRIC LOCOMOTIVE

Clockwork Models



No. O "SILVER LINK" LOCOMOTIVE



No. 1 SPECIAL LOCOMOTIVE



No. 2 SPECIAL TANK LOCOMOTIVE

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No. 2 Special Tank Locomotive (reversing). Price **19/6**

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